Service Manual

(Model 07066)

Pro Sweep

Preface

The purpose of this publication is to provide the service technician with information for troubleshooting, testing and repair of major systems and components on the Pro Sweep (Model 07066).

REFER TO THE OPERATOR'S MANUAL FOR OPERATING, MAINTENANCE AND ADJUSTMENT INSTRUCTIONS. Space is provided in Chapter 2 of this book to insert the Operator's Manual and Parts Catalog for your machine. Additional copies of the Operator's Manual and Parts Catalog are available on the internet at www.Toro.com.

The Toro Company reserves the right to change product specifications or this publication without notice.

This safety symbol means DANGER, WARNING, or CAUTION, PERSONAL SAFETY INSTRUCTION. When you see this symbol, carefully read the instructions that follow. Failure to obey the instructions may result in personal injury.

NOTE: A **NOTE** will give general information about the correct operation, maintenance, service, testing or repair of the machine.

IMPORTANT: The IMPORTANT notice will give important instructions which must be followed to prevent damage to systems or components on the machine.

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Safety

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Safety Instructions

The Pro Sweep is designed and tested to offer safe service when operated and maintained properly. Although hazard control and accident prevention partially are dependent upon the design and configuration of the machine, these factors are also dependent upon the awareness, concern and proper training of the personnel involved in the operation, transport, maintenance and storage of the machine. Improper use or maintenance of the machine can result in injury or death. To reduce the potential for injury or death, comply with the following safety instructions.

WARNING

To reduce the potential for injury or death, comply with the following safety instructions.

Before Operating

1. Read and understand the contents of the Operator's Manual before operating the machine. Become familiar with the controls and know how to stop the sweeper quickly. Additional copies of the Operator's Manual are available on the internet at www.Toro.com.

2. Keep all shields, safety devices and decals in place. If a shield, safety device or decal is defective, illegible or damaged, repair or replace it before operating the machine.

3. Make sure that any loose nuts, bolts or screws are tightened to ensure that the machine is in safe operating condition.

4. Make sure that the tow vehicle is carefully selected to assure the best performance and safe operation of the Pro Sweep.

5. Assure sweeper interlock system functions correctly so sweeper brush does not rotate unless sweeper is positioned below the transport position.

6. Make sure that operator is familiar with tow vehicle operation.

While Operating

1. Operator should be in the operators position when operating the tow vehicle and sweeper. Stay away from the sweeper when the brush is engaged.

2. Make sure that hitch pin is properly positioned in tow vehicle and sweeper. Hitch pin should be secured with hairpin clip.

3. Do not run tow vehicle engine in a confined area without adequate ventilation. Exhaust fumes are hazardous and could possibly be deadly.

4. Do not touch tow vehicle engine, muffler or exhaust pipe while engine is running or soon after it is stopped. These areas could be hot enough to cause burns.

5. If abnormal vibration is detected, stop tow vehicle and sweeper immediately and determine source of vibration. Correct problems before resuming the use of sweeper.

6. While operating, the Pro Sweep may exceed noise levels of 85dB(A) at the operator position. Hearing protection is recommended for prolonged exposure to reduce the potential of permanent hearing damage.

7. Before leaving the operator's position of the tow vehicle:

   A. Stop sweeper brush by shutting off vehicle hydraulic flow to the sweeper.

   B. Make sure that dump hopper is lowered.

   C. Ensure that vehicle traction lever is in neutral, apply parking brake, stop engine and remove key from ignition switch.

8. Position sweeper on level surface, empty hopper and chock sweeper wheels before disconnecting Pro Sweep from tow vehicle.

Maintenance and Service

1. Before servicing or making adjustments, empty Pro Sweep hopper and position sweeper on a level surface. Chock sweeper wheels to prevent it from moving. If sweeper is attached to tow vehicle, apply tow vehicle parking brake, stop engine and remove key from the ignition switch.

2. Make sure machine is in safe operating condition by keeping all nuts, bolts and screws tight.

3. Make sure all hydraulic line connectors are tight and all hydraulic hoses and lines are in good condition before applying pressure to the hydraulic system.

4. Keep body and hands away from pin hole leaks in hydraulic lines that eject high pressure hydraulic fluid. Use cardboard or paper to find hydraulic leaks. Hydraulic fluid escaping under pressure can penetrate skin and cause injury. Hydraulic fluid accidentally injected into the skin must be surgically removed within a few hours by a doctor familiar with this form of injury or gangrene may result.

5. Before disconnecting any hydraulic component or performing any work on the hydraulic system, all pressure in system must be relieved. See Relieving Hydraulic System Pressure in the General Information section of Chapter 3 – Hydraulic System.

6. If hopper is to be raised, make sure that sweeper is not placed in the offset position.

7. If hopper is raised, install hopper safety support on lift cylinder to ensure that unexpected shifting of sweeper frame does not occur.

8. Disconnect electrical power harness from tow vehicle before servicing the sweeper.

9. If major repairs are ever needed or assistance is desired, contact an Authorized Toro Distributor.

10. At the time of manufacture, the machine conformed to all applicable safety standards. To assure optimum performance and continued safety certification of the machine, use genuine Toro replacement parts and accessories. Replacement parts and accessories made by other manufacturers may result in non-conformance with the safety standards, and the warranty may be voided.

11. When changing tires or performing other service, use correct hoists and jacks. Make sure machine is parked on a solid level surface such as a concrete floor with the hopper empty and lowered. Have sweeper attached to towing vehicle, apply vehicle parking brake, stop engine and remove key from the ignition switch. Always chock or block wheels. Use appropriate jack stands to support the raised machine. If the machine is not properly supported by appropriate jack stands, the machine may move or fall, which may result in personal injury (see Jacking Instructions in this chapter).

Jacking Instructions

CAUTION

When changing tires or performing other service, use correct hoists and jacks to support sweeper. Make sure machine is parked on a solid level surface such as a concrete floor. Always chock or block wheels. Use appropriate jack stands to support the raised machine. If the machine is not properly supported by appropriate jack stands, the machine may move or fall, which may result in personal injury.

1. Position sweeper on a level surface with dump hopper empty and lowered. Have sweeper attached to towing vehicle, apply vehicle parking brake, stop engine and remove key from the ignition switch. Chock sweeper wheels to prevent it from moving.

2. Position jack securely under the main sweeper frame (Fig. 1). Do not use the axle as a jacking point.

3. Carefully jack machine off the ground.

4. Position appropriate jack stands under the main frame to support the sweeper.

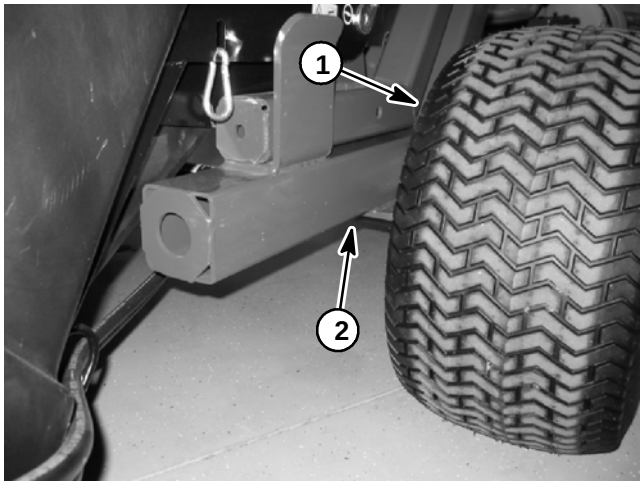

Figure 1

1. Wheel **2. Frame jacking point**

Securing Pro Sweep to Tow Vehicle

While operating or servicing the Pro Sweep, make sure that hitch pin is properly positioned in tow vehicle hitch and sweeper tongue. Hitch pin should be secured with hairpin clip (Fig. 2).

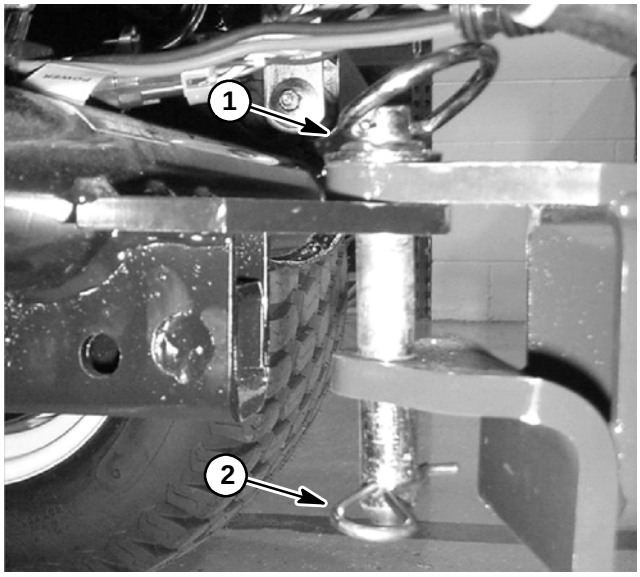

Figure 2

1. **Hitch pin**
2. **Hairpin clip**

Safety and Instruction Decals

Numerous safety and instruction decals are affixed to the Pro Sweep. If any decal becomes illegible or damaged, install a new decal. Part numbers for replacement decals are listed in your Parts Catalog. Order replacement decals from your Authorized Toro Distributor.

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Chapter 2

Product Records and Maintenance

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Product Records

Insert Operator's Manual and Parts Catalog for your Pro Sweep at the end of this chapter. Additionally, if any optional equipment or accessories have been installed to your machine, insert the Installation Instructions, Operator's Manuals and Parts Catalogs for those options at the end of this chapter.

Maintenance

Maintenance procedures and recommended service intervals for the Pro Sweep are covered in the Operator's Manual. Refer to that publication when performing regular equipment maintenance.

Equivalents and Conversions

Decimal and Millimeter Equivalents

Fractions	Decimals	mm	Fractions	Decimals	mm
1/64	0.015625	— 0.397	33/64	0.515625	— 13.097
1/32	0.03125	— 0.794	17/32	0.53125	— 13.494
3/64	0.046875	— 1.191	35/64	0.546875	— 13.891
1/16	0.0625	— 1.588	9/16	0.5625	— 14.288
5/64	0.078125	— 1.984	37/64	0.578125	— 14.684
3/32	0.09375	— 2.381	19/32	0.59375	— 15.081
7/64	0.109275	— 2.778	39/64	0.609375	— 15.478
1/8	0.1250	— 3.175	**5/8**	0.6250	— 15.875
9/64	0.140625	— 3.572	41/64	0.640625	— 16.272
5/32	0.15625	— 3.969	21/32	0.65625	— 16.669
11/64	0.171875	— 4.366	43/64	0.671875	— 17.066
3/16	0.1875	— 4.762	11/16	0.6875	— 17.462
13/64	0.203125	— 5.159	45/64	0.703125	— 17.859
7/32	0.21875	— 5.556	23/32	0.71875	— 18.256
15/64	0.234375	— 5.953	47/64	0.734375	— 18.653
1/4	0.2500	— 6.350	**3/4**	0.7500	— 19.050
17/64	0.265625	— 6.747	49/64	0.765625	— 19.447
9/32	0.28125	— 7.144	25/32	0.78125	— 19.844
19/64	0.296875	— 7.541	51/64	0.796875	— 20.241
5/16	0.3125	— 7.938	13/16	0.8125	— 20.638
21/64	0.328125	— 8.334	53/64	0.828125	— 21.034
11/32	0.34375	— 8.731	27/32	0.84375	— 21.431
23/64	0.359375	— 9.128	55/64	0.859375	— 21.828
3/8	0.3750	— 9.525	**7/8**	0.8750	— 22.225
25/64	0.390625	— 9.922	57/64	0.890625	— 22.622
13/32	0.40625	— 10.319	29/32	0.90625	— 23.019
27/64	0.421875	— 10.716	59/64	0.921875	— 23.416
7/16	0.4375	— 11.112	15/16	0.9375	— 23.812
29/64	0.453125	— 11.509	61/64	0.953125	— 24.209
15/32	0.46875	— 11.906	31/32	0.96875	— 24.606
31/64	0.484375	— 12.303	63/64	0.984375	— 25.003
1/2	0.5000	— 12.700	**1**	1.000	— 25.400

1 mm = 0.03937 in. **0.001 in. = 0.0254 mm**

U.S.to Metric Conversions

	To Convert	Into	Multiply By
Linear Measurement	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
Area	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
Volume	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
Weight	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
Pressure	Pounds/Sq. In.	Kilopascal	6.895
	Pounds/Sq. In.	Bar	0.069
Work	Foot-pounds	Newton-Meters	1.356
	Foot-pounds	Kilogram-Meters	0.1383
	Inch-pounds	Kilogram-Centimeters	1.152144
Liquid Volume	Quarts	Liters	0.9463
	Gallons	Liters	3.785
Liquid Flow	Gallons/Minute	Liters/Minute	3.785
Temperature	Fahrenheit	Celsius	1. Subract 32° 2. Multiply by 5/9

Torque Specifications

Recommended fastener torque values are listed in the following tables. For critical applications, as determined by Toro, either the recommended torque or a torque that is unique to the application is clearly identified and specified in this Service Manual.

These Torque Specifications for the installation and tightening of fasteners shall apply to all fasteners which do not have a specific requirement identified in this Service Manual. The following factors shall be considered when applying torque: cleanliness of the fastener, use of a thread sealant (e.g. Loctite), degree of lubrication on the fastener, presence of a prevailing torque feature, hardness of the surface underneath the fastener's head or similar condition which affects the installation.

As noted in the following tables, torque values should be **reduced by 25% for lubricated fasteners** to achieve the similar stress as a dry fastener. Torque values may also have to be reduced when the fastener is threaded into aluminum or brass. The specific torque value should be determined based on the aluminum or brass material strength, fastener size, length of thread engagement, etc.

The standard method of verifying torque shall be performed by marking a line on the fastener (head or nut) and mating part, then back off fastener 1/4 of a turn. Measure the torque required to tighten the fastener until the lines match up.

Fastener Identification

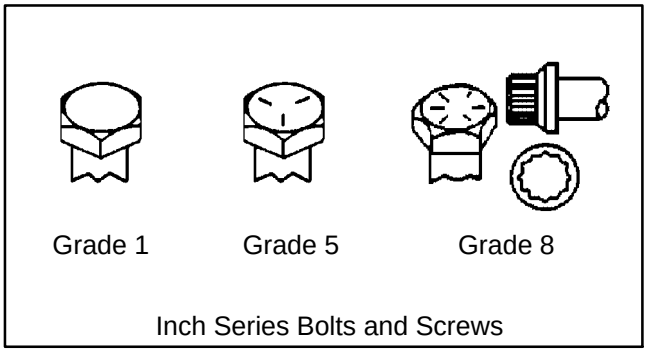

Figure 1

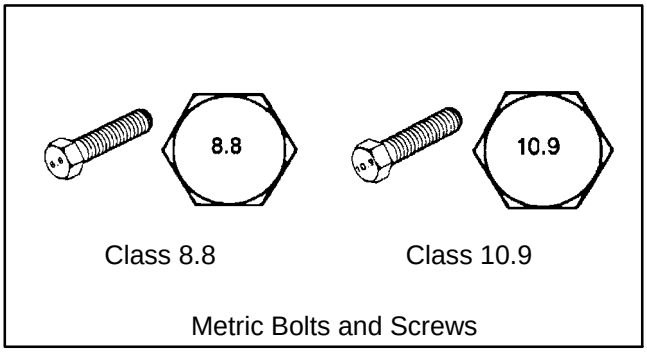

Figure 2

Using a Torque Wrench with an Offset Wrench

Use of an offset wrench (e.g. crowfoot wrench) will affect torque wrench calibration due to the effective change of torque wrench length. When using a torque wrench with an offset wrench, multiply the listed torque recommendation by the calculated torque conversion factor (Fig. 3) to determine proper tightening torque. Tightening torque when using a torque wrench with an offset wrench will be lower than the listed torque recommendation.

Example: The measured effective length of the torque wrench (distance from the center of the handle to the center of the square drive) is 18".

The measured effective length of the torque wrench with the offset wrench installed (distance from the center of the handle to the center of the offset wrench) is 19".

The calculated torque conversion factor for this torque wrench with this offset wrench would be 18 / 19 = 0.947.

If the listed torque recommendation for a fastener is from 76 to 94 ft-lb, the proper torque when using this torque wrench with an offset wrench would be from 72 to 89 ft-lb.

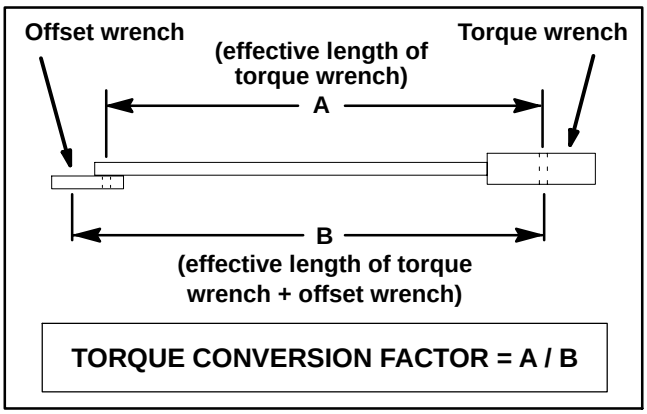

Figure 3

Standard Torque for Dry, Zinc Plated and Steel Fasteners (Inch Series)

Thread Size	Grade 1, 5 & 8 with Thin Height Nuts	SAE Grade 1 Bolts, Screws, Studs & Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 5 Bolts, Screws, Studs & Sems with Regular Height Nuts (SAE J995 Grade 2 or Stronger Nuts)		SAE Grade 8 Bolts, Screws, Studs & Sems with Regular Height Nuts (SAE J995 Grade 5 or Stronger Nuts)	
	in-lb	**in-lb**	**N-cm**	**in-lb**	**N-cm**	**in-lb**	**N-cm**
# 6 - 32 UNC	10 ± 2	13 ± 2	147 ± 23	15 ± 2	169 ± 23	23 ± 3	262 ± 34
# 6 - 40 UNF				17 ± 2	192 ± 23	25 ± 3	282 ± 34
# 8 - 32 UNC	13 ± 2	25 ± 5	282 ± 30	29 ± 3	328 ± 34	41 ± 5	463 ± 56
# 8 - 36 UNF				31 ± 4	350 ± 45	43 ± 5	486 ± 56
# 10 - 24 UNC	18 ± 2	30 ± 5	339 ± 56	42 ± 5	475 ± 56	60 ± 6	678 ± 68
# 10 - 32 UNF				48 ± 5	542 ± 56	68 ± 7	768 ± 79
1/4 - 20 UNC	48 ± 7	53 ± 7	599 ± 79	100 ± 10	1130 ± 113	140 ± 15	1582 ± 169
1/4 - 28 UNF	53 ± 7	65 ± 10	734 ± 113	115 ± 12	1299 ± 136	160 ± 17	1808 ± 192
5/16 - 18 UNC	115 ± 15	105 ± 15	1186 ± 169	200 ± 25	2260 ± 282	300 ± 30	3390 ± 339
5/16 - 24 UNF	138 ± 17	128 ± 17	1446 ± 192	225 ± 25	2542 ± 282	325 ± 33	3672 ± 373
	ft-lb	**ft-lb**	**N-m**	**ft-lb**	**N-m**	**ft-lb**	**N-m**
3/8 - 16 UNC	16 ± 2	16 ± 2	22 ± 3	30 ± 3	41 ± 4	43 ± 5	58 ± 7
3/8 - 24 UNF	17 ± 2	18 ± 2	24 ± 3	35 ± 4	47 ± 5	50 ± 6	68 ± 8
7/16 - 14 UNC	27 ± 3	27 ± 3	37 ± 4	50 ± 5	68 ± 7	70 ± 7	95 ± 9
7/16 - 20 UNF	29 ± 3	29 ± 3	39 ± 4	55 ± 6	75 ± 8	77 ± 8	104 ± 11
1/2 - 13 UNC	30 ± 3	48 ± 7	65 ± 9	75 ± 8	102 ± 11	105 ± 11	142 ± 15
1/2 - 20 UNF	32 ± 4	53 ± 7	72 ± 9	85 ± 9	115 ± 12	120 ± 12	163 ± 16
5/8 - 11 UNC	65 ± 10	88 ± 12	119 ± 16	150 ± 15	203 ± 20	210 ± 21	285 ± 28
5/8 - 18 UNF	75 ± 10	95 ± 15	129 ± 20	170 ± 18	230 ± 24	240 ± 24	325 ± 33
3/4 - 10 UNC	93 ± 12	140 ± 20	190 ± 27	265 ± 27	359 ± 37	375 ± 38	508 ± 52
3/4 - 16 UNF	115 ± 15	165 ± 25	224 ± 34	300 ± 30	407 ± 41	420 ± 43	569 ± 58
7/8 - 9 UNC	140 ± 20	225 ± 25	305 ± 34	430 ± 45	583 ± 61	600 ± 60	813 ± 81
7/8 - 14 UNF	155 ± 25	260 ± 30	353 ± 41	475 ± 48	644 ± 65	667 ± 66	904 ± 89

NOTE: Reduce torque values listed in the table above by 25% for lubricated fasteners. Lubricated fasteners are defined as threads coated with a lubricant such as engine oil or thread sealant such as Loctite.

NOTE: Torque values may have to be reduced when installing fasteners into threaded aluminum or brass. The specific torque value should be determined based on the fastener size, the aluminum or base material strength, length of thread engagement, etc.

NOTE: The nominal torque values listed above for Grade 5 and 8 fasteners are based on 75% of the minimum proof load specified in SAE J429. The tolerance is approximately ± 10% of the nominal torque value. Thin height nuts include jam nuts.

Standard Torque for Dry, Zinc Plated and Steel Fasteners (Metric Fasteners)

Thread Size	Class 8.8 Bolts, Screws and Studs with Regular Height Nuts (Class 8 or Stronger Nuts)		Class 10.9 Bolts, Screws and Studs with Regular Height Nuts (Class 10 or Stronger Nuts)	
M5 X 0.8	57 ± 6 in-lb	644 ± 68 N-cm	78 ± 8 in-lb	881 ± 90 N-cm
M6 X 1.0	96 ± 10 in-lb	1085 ± 113 N-cm	133 ± 14 in-lb	1503 ± 158 N-cm
M8 X 1.25	19 ± 2 ft-lb	26 ± 3 N-m	28 ± 3 ft-lb	38 ± 4 N-m
M10 X 1.5	38 ± 4 ft-lb	52 ± 5 N-m	54 ± 6 ft-lb	73 ± 8 N-m
M12 X 1.75	66 ± 7 ft-lb	90 ± 10 N-m	93 ± 10 ft-lb	126 ± 14 N-m
M16 X 2.0	166 ± 17 ft-lb	225 ± 23 N-m	229 ± 23 ft-lb	310 ± 31 N-m
M20 X 2.5	325 ± 33 ft-lb	440 ± 45 N-m	450 ± 46 ft-lb	610 ± 62 N-m

NOTE: Reduce torque values listed in the table above by 25% for lubricated fasteners. Lubricated fasteners are defined as threads coated with a lubricant such as engine oil or thread sealant such as Loctite.

NOTE: Torque values may have to be reduced when installing fasteners into threaded aluminum or brass. The specific torque value should be determined based on the fastener size, the aluminum or base material strength, length of thread engagement, etc.

NOTE: The nominal torque values listed above are based on 75% of the minimum proof load specified in SAE J1199. The tolerance is approximately ± 10% of the nominal torque value.

Other Torque Specifications

SAE Grade 8 Steel Set Screws

Thread Size	Recommended Torque	
	Square Head	Hex Socket
1/4 – 20 UNC	140 ± 20 in–lb	73 ± 12 in–lb
5/16 – 18 UNC	215 ± 35 in–lb	145 ± 20 in–lb
3/8 – 16 UNC	35 ± 10 ft–lb	18 ± 3 ft–lb
1/2 – 13 UNC	75 ± 15 ft–lb	50 ± 10 ft–lb

Wheel Bolts and Lug Nuts

Thread Size	Recommended Torque**	
7/16 – 20 UNF Grade 5	65 ± 10 ft–lb	88 ± 14 N–m
1/2 – 20 UNF Grade 5	80 ± 10 ft–lb	108 ± 14 N–m
M12 X 1.25 Class 8.8	80 ± 10 ft–lb	108 ± 14 N–m
M12 X 1.5 Class 8.8	80 ± 10 ft–lb	108 ± 14 N–m

** For steel wheels and non–lubricated fasteners.

Thread Cutting Screws (Zinc Plated Steel)

Type 1, Type 23 or Type F	
Thread Size	**Baseline Torque***
No. 6 – 32 UNC	20 ± 5 in–lb
No. 8 – 32 UNC	30 ± 5 in–lb
No. 10 – 24 UNC	38 ± 7 in–lb
1/4 – 20 UNC	85 ± 15 in–lb
5/16 – 18 UNC	110 ± 20 in–lb
3/8 – 16 UNC	200 ± 100 in–lb

Thread Cutting Screws (Zinc Plated Steel)

Thread Size	Threads per Inch		Baseline Torque*
	Type A	Type B	
No. 6	18	20	20 ± 5 in–lb
No. 8	15	18	30 ± 5 in–lb
No. 10	12	16	38 ± 7 in–lb
No. 12	11	14	85 ± 15 in–lb

* Hole size, material strength, material thickness & finish must be considered when determining specific torque values. All torque values are based on non–lubricated fasteners.

Conversion Factors

in–lb X 11.2985 = N–cm
ft–lb X 1.3558 = N–m

N–cm X 0.08851 = in–lb
N–m X 0.7376 = ft–lb

Chapter 3

Hydraulic System

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PARKER TORQLINK™ SERVICE PROCEDURE

General Information

Operator's Manual

The Operator's Manual provides information regarding the operation, general maintenance and maintenance intervals for your Pro Sweep machine. Refer to that publication for additional information when servicing the machine.

Hydraulic Hoses

Hydraulic hoses are subject to extreme conditions such as pressure differentials during operation and exposure to weather, sun, chemicals, very warm storage conditions or mishandling during operation and maintenance. These conditions can cause hose damage and deterioration. Some hoses are more susceptible to these conditions than others. Inspect all machine hydraulic hoses frequently for signs of deterioration or damage:

Hard, cracked, cut, abraded, charred, leaking or otherwise damaged hose.

Kinked, crushed, flattened or twisted hose.

Blistered, soft, degraded or loose hose cover.

Cracked, damaged or badly corroded hose fittings.

When replacing a hydraulic hose, be sure that the hose is straight (not twisted) before tightening the fittings. This can be done by observing the imprint (layline) on the hose. Use two wrenches when tightening a hose; hold the hose straight with one wrench and tighten the hose swivel nut onto the fitting with the second wrench (see Hydraulic Hose and Tube Installation in this section). If the hose has an elbow at one end, tighten the swivel nut on that end before tightening the nut on the straight end of the hose.

For additional hydraulic hose information, refer to Toro Service Training Book, Hydraulic Hose Servicing (Part Number 94813SL).

WARNING

Before disconnecting or performing any work on hydraulic system, relieve all pressure in system (see Relieving Hydraulic System Pressure in this section).

Keep body and hands away from pin hole leaks or nozzles that eject hydraulic fluid under high pressure. Use paper or cardboard, not hands, to search for leaks. Hydraulic fluid escaping under pressure can have sufficient force to penetrate the skin and cause serious injury. If fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury. Gangrene may result from such an injury.

Hydraulic Hose and Tube Installation (O-Ring Face Seal Fitting)

1. Make sure threads and sealing surfaces of the hose/tube and the fitting are free of burrs, nicks, scratches or any foreign material.

2. As a preventative measure against leakage, it is recommended that the face seal O-ring be replaced any time the connection is opened. Make sure the O-ring is installed and properly seated in the fitting groove. Lightly lubricate the O-ring with clean hydraulic oil.

3. Place the hose/tube against the fitting body so that the flat face of the hose/tube sleeve fully contacts the O-ring in the fitting.

4. Thread the swivel nut onto the fitting by hand. While holding the hose/tube with a wrench, use a torque wrench to tighten the swivel nut to the recommended installation torque shown in Figure 3. This tightening process will require the use of an offset wrench (e.g. crowfoot wrench). Use of an offset wrench will affect torque wrench calibration due to the effective length change of the torque wrench. Tightening torque when using a torque wrench with an offset wrench will be lower than the listed installation torque (see Using a Torque Wrench with an Offset Wrench in the Torque Specifications section of Chapter 2 – Product Records and Maintenance).

5. If a torque wrench is not available or if space at the swivel nut prevents use of a torque wrench, an alternate method of assembly is the Flats From Wrench Resistance (F.F.W.R.) method (Fig. 2).

A. Using a wrench, tighten the swivel nut onto the fitting until light wrench resistance is reached (approximately 30 in-lb).

B. Mark the swivel nut and fitting body. Hold the hose/tube with a wrench to prevent it from turning.

C. Use a second wrench to tighten the nut to the correct Flats From Wrench Resistance (F.F.W.R.). The markings on the nut and fitting body will verify that the connection has been properly tightened.

Size	F.F.W.R.
4 (1/4 in. nominal hose or tubing)	1/2 to 3/4
6 (3/8 in.)	1/2 to 3/4
8 (1/2 in.)	1/2 to 3/4
10 (5/8 in.)	1/2 to 3/4
12 (3/4 in.)	1/3 to 1/2
16 (1 in.)	1/3 to 1/2

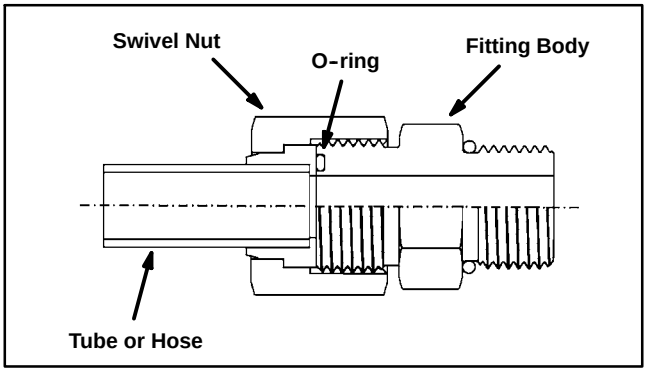


Figure 1

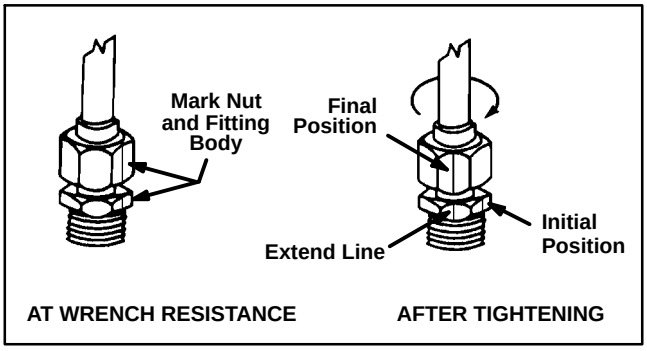


Figure 2

Fitting Dash Size	Hose/Tube Side Thread Size	Installation Torque
4	9/16 – 18	18 to 22 ft-lb (25 to 29 N-m)
6	11/16 – 16	27 to 33 ft-lb (37 to 44 N-m)
8	13/16 – 16	37 to 47 ft-lb (51 to 63 N-m)
10	1 – 14	60 to 74 ft-lb (82 to 100 N-m)
12	1 3/16 – 12	85 to 105 ft-lb (116 to 142 N-m)
16	1 7/16 – 12	110 to 136 ft-lb (150 to 184 N-m)
20	1 11/16 – 12	140 to 172 ft-lb (190 to 233 N-m)

Figure 3

Hydraulic Fitting Installation (SAE Straight Thread O-Ring Fitting into Component Port)

Non-Adjustable Fitting (Fig. 4)

1. Make sure all threads and sealing surfaces of fitting and component port are free of burrs, nicks, scratches or any foreign material.

2. As a preventative measure against leakage, it is recommended that the O-ring be replaced any time the connection is opened.

3. Lightly lubricate the O-ring with clean hydraulic oil. Fitting threads should be clean with no lubricant applied.

IMPORTANT: Before installing fitting into port, determine port material. If fitting is to be installed into an aluminum port, installation torque is reduced.

4. Install the fitting into the port. Then, use a torque wrench and socket to tighten the fitting to the recommended installation torque shown in Figure 5.

NOTE: Use of an offset wrench (e.g. crowfoot wrench) will affect torque wrench calibration due to the effective length change of the torque wrench. Tightening torque when using a torque wrench with an offset wrench will be less than the recommended installation torque. See Using a Torque Wrench with an Offset Wrench in the Torque Specifications section of Chapter 2 – Product Records and Maintenance to determine necessary conversion information.

5. If a torque wrench is not available, or if space at the port prevents use of a torque wrench, an alternate method of assembly is the Flats From Finger Tight (F.F.F.T.) method.

A. Install the fitting into the port and tighten it down full length until finger tight.

B. If port material is steel, tighten the fitting to the listed F.F.F.T. If port material is aluminum, tighten fitting to 60% of listed F.F.F.T.

Size	F.F.F.T.
4 (1/4 in. nominal hose or tubing)	1.00 ± 0.25
6 (3/8 in.)	1.50 ± 0.25
8 (1/2 in.)	1.50 ± 0.25
10 (5/8 in.)	1.50 ± 0.25
12 (3/4 in.)	1.50 ± 0.25
16 (1 in.)	1.50 ± 0.25

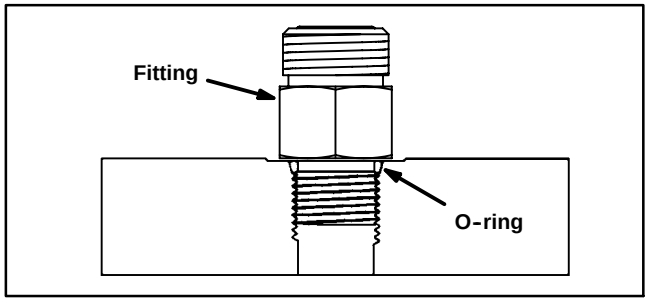


Figure 4

Fitting Dash Size	Fitting Port Side Thread Size	Installation Torque Into Steel Port	Installation Torque Into Aluminum Port
4	7/16 – 20	15 to 19 ft-lb (21 to 25 N-m)	9 to 11 ft-lb (13 to 15 N-m)
5	1/2 – 20	18 to 22 ft-lb (25 to 29 N-m)	11 to 15 ft-lb (15 to 20 N-m)
6	9/16 – 18	34 to 42 ft-lb (47 to 56 N-m)	20 to 26 ft-lb (28 to 35 N-m)
8	3/4 – 16	58 to 72 ft-lb (79 to 97 N-m)	35 to 43 ft-lb (48 to 58 N-m)
10	7/8 – 14	99 to 121 ft-lb (135 to 164 N-m)	60 to 74 ft-lb (82 to 100 N-m)
12	1 1/16 – 12	134 to 164 ft-lb (182 to 222 N-m)	81 to 99 ft-lb (110 to 134 N-m)
14	1 3/16 – 12	160 to 196 ft-lb (217 to 265 N-m)	96 to 118 ft-lb (131 to 160 N-m)
16	1 5/16 – 12	202 to 248 ft-lb (274 to 336 N-m)	121 to 149 ft-lb (165 to 202 N-m)
20	1 5/8 – 12	247 to 303 ft-lb (335 to 410 N-m)	149 to 183 ft-lb (202 to 248 N-m)

Figure 5

Adjustable Fitting (Fig. 6)

1. Make sure all threads and sealing surfaces of fitting and component port are free of burrs, nicks, scratches or any foreign material.

2. As a preventative measure against leakage, it is recommended that the O-ring be replaced any time the connection is opened.

3. Lightly lubricate the O-ring with clean hydraulic oil. Fitting threads should be clean with no lubricant applied.

4. Turn back the lock nut as far as possible. Make sure the back up washer is not loose and is pushed up as far as possible (Step 1 in Figure 7).

IMPORTANT: Before installing fitting into port, determine port material. If fitting is to be installed into an aluminum port, installation torque is reduced.

5. Install the fitting into the port and tighten finger tight until the washer contacts the face of the port (Step 2 in Figure 7). Make sure that the fitting does not bottom in the port during installation.

6. To put the fitting in the desired position, unscrew it by the required amount to align fitting with incoming hose or tube, but no more than one full turn (Step 3 in Figure 7).

7. Hold the fitting in the desired position with a wrench and use a torque wrench to tighten the lock nut to the recommended installation torque shown in Figure 5. This tightening process will require the use of an offset wrench (e.g. crowfoot wrench). Use of an offset wrench will affect torque wrench calibration due to the effective length change of the torque wrench. Tightening torque when using a torque wrench with an offset wrench will be lower than the listed installation torque (see Using a Torque Wrench with an Offset Wrench in the Torque Specifications section of Chapter 2 – Product Records and Maintenance).

8. If a torque wrench is not available, or if space at the port prevents use of a torque wrench, an alternate method of assembly is the Flats From Finger Tight (F.F.F.T.) method. Hold the fitting in the desired position with a wrench and, if port material is steel, tighten the lock nut with a second wrench to the listed F.F.F.T (Step 4 in Figure 7). If port material is aluminum, tighten fitting to 60% of listed F.F.F.T.

Size	F.F.F.T.
4 (1/4 in. nominal hose or tubing)	1.00 ± 0.25
6 (3/8 in.)	1.50 ± 0.25
8 (1/2 in.)	1.50 ± 0.25
10 (5/8 in.)	1.50 ± 0.25
12 (3/4 in.)	1.50 ± 0.25
16 (1 in.)	1.50 ± 0.25

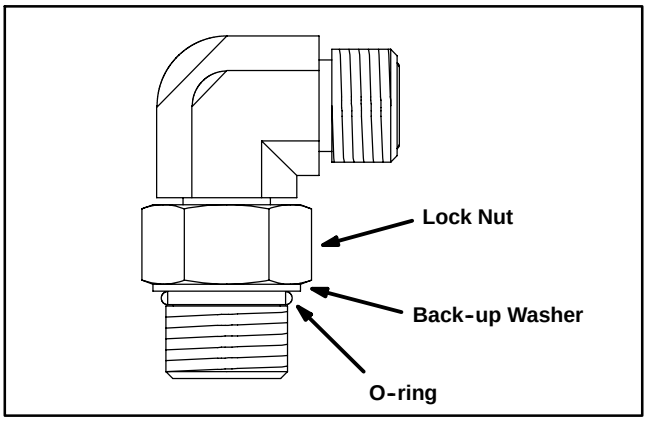


Figure 6

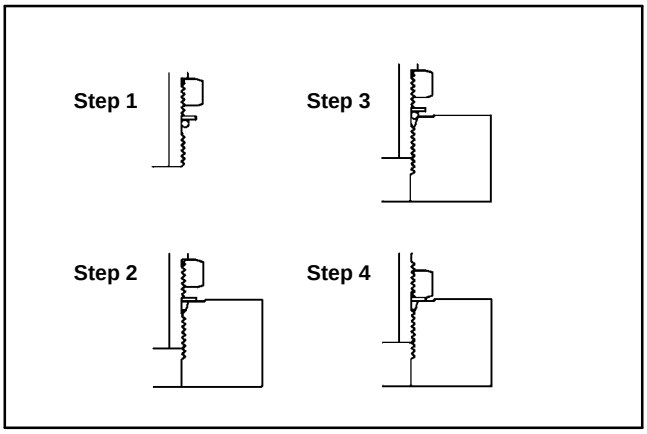


Figure 7

Relieving Hydraulic System Pressure

CAUTION

Before disconnecting any hydraulic components, operate all sweeper hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil.

Before disconnecting or performing any work on the Pro Sweep hydraulic system, all pressure in the hydraulic system must be relieved. Position sweeper on a level surface with dump hopper empty and fully lowered. Turn tow vehicle key switch to OFF and allow engine to stop.

Make sure that the sweeper has electrical power and that sweeper control module is energized (control module Time Out and Power LED's are both illuminated). With the tow vehicle engine not running, press all remote transmitter buttons to energize the solenoids on the hydraulic control manifold. After all functions have been energized, make sure tow vehicle key switch is OFF and key is removed from ignition switch.

Securing Pro Sweep to Tow Vehicle

While servicing the Pro Sweep, make sure that the hitch pin is properly positioned in tow vehicle hitch and sweeper tongue (Fig. 8). Hitch pin should be secured with hairpin clip.

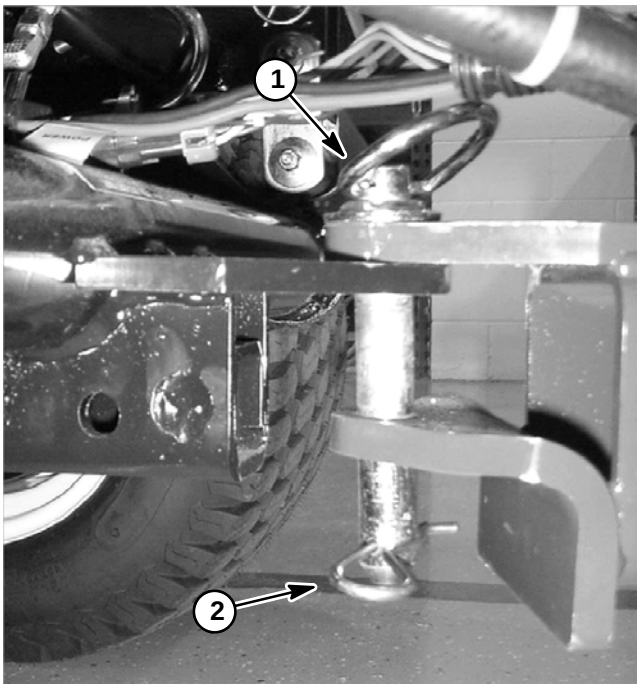
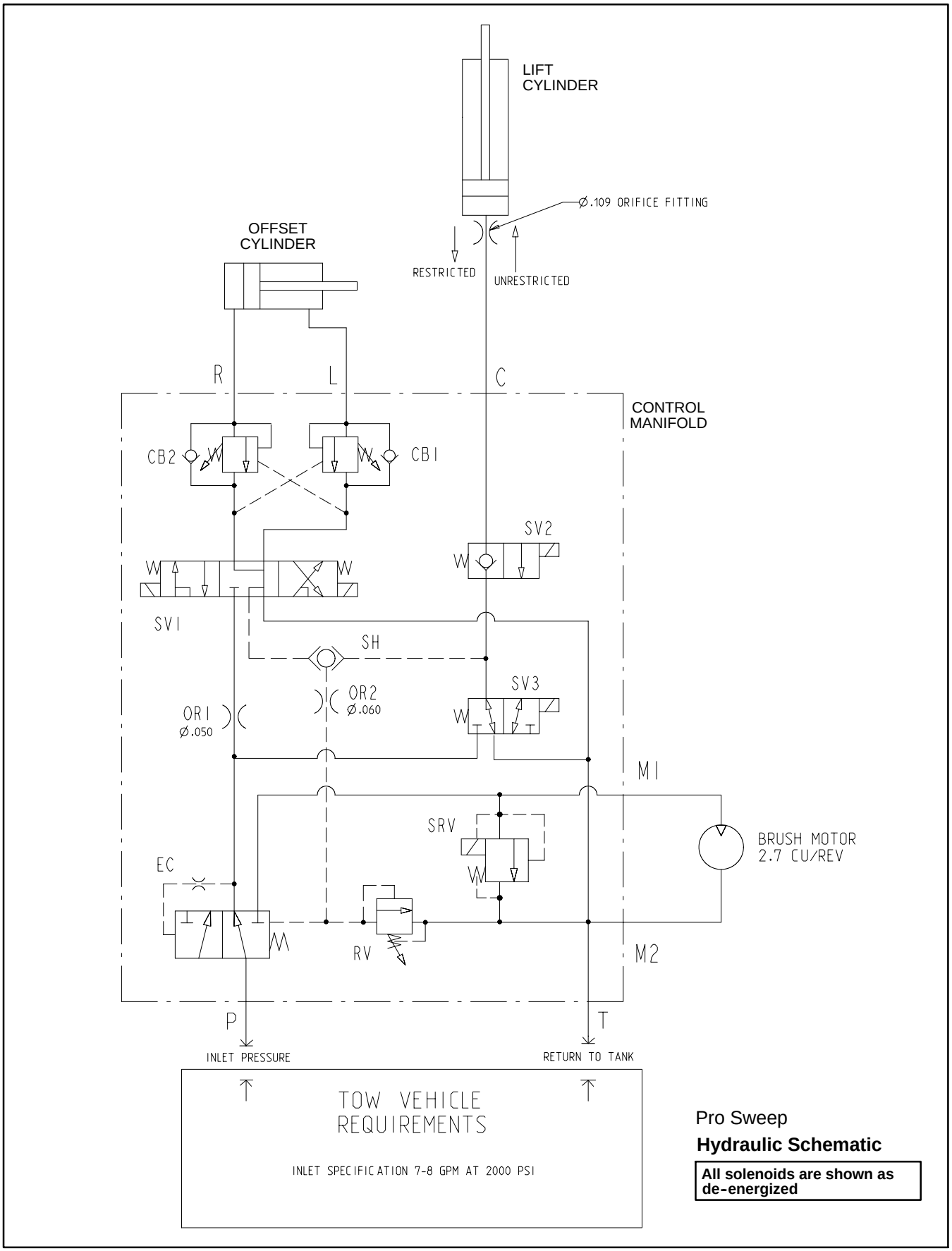


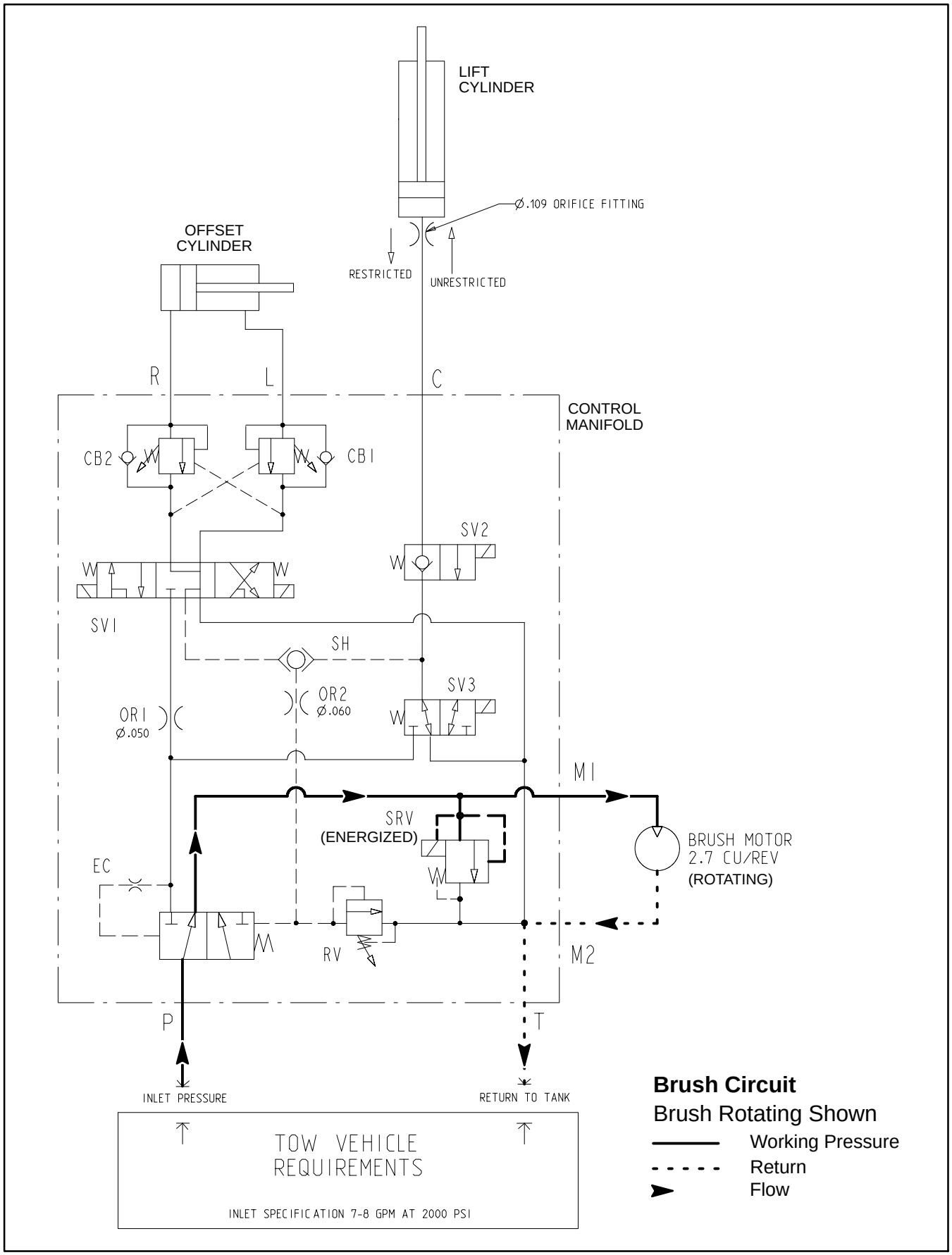
Figure 8

1. **Hitch pin**
2. **Hairpin clip**

Hydraulic Schematic



Hydraulic Flow Diagrams



Brush Circuit

NOTE: Hydraulic flow and relief pressure for the Pro Sweep are determined by the tow vehicle.

When the tow vehicle hydraulics are engaged for the sweeper, hydraulic flow from the tow vehicle goes to the sweeper control manifold (port P) through the hydraulic inlet hose. If the sweeper brush motor is not engaged (sweeper is raised above the transport height) and the lift and offset cylinders are stationary, hydraulic flow from the tow vehicle is directed by the control manifold pressure compensator valve EC and the de–energized solenoid valve SRV to return to the tow vehicle through control manifold port T and the return to tank hose (Fig. 9).

Brush Engage

When the sweeper is below the transport height, solenoid valve SRV in the hydraulic control manifold is energized. In this sweeper position, energized SRV shifts to prevent hydraulic flow return to the tow vehicle when the tow vehicle hydraulics are engaged. Hydraulic flow from the tow vehicle is then directed out of control manifold port M1 to the brush motor. This flow causes rotation of the sweeper brush. Oil return from the brush motor is routed to control manifold port M2, out control manifold port T and returns to the tow vehicle.

During sweeper brush operation, solenoid valve SRV also functions as a circuit relief valve. If brush circuit pressure reaches 2500 PSI (172 bar), SRV will shift to reduce circuit pressure.

Brush Disengage

The brush can be disengaged either by shutting off hydraulic flow from the tow vehicle or by raising the sweeper to the transport position.

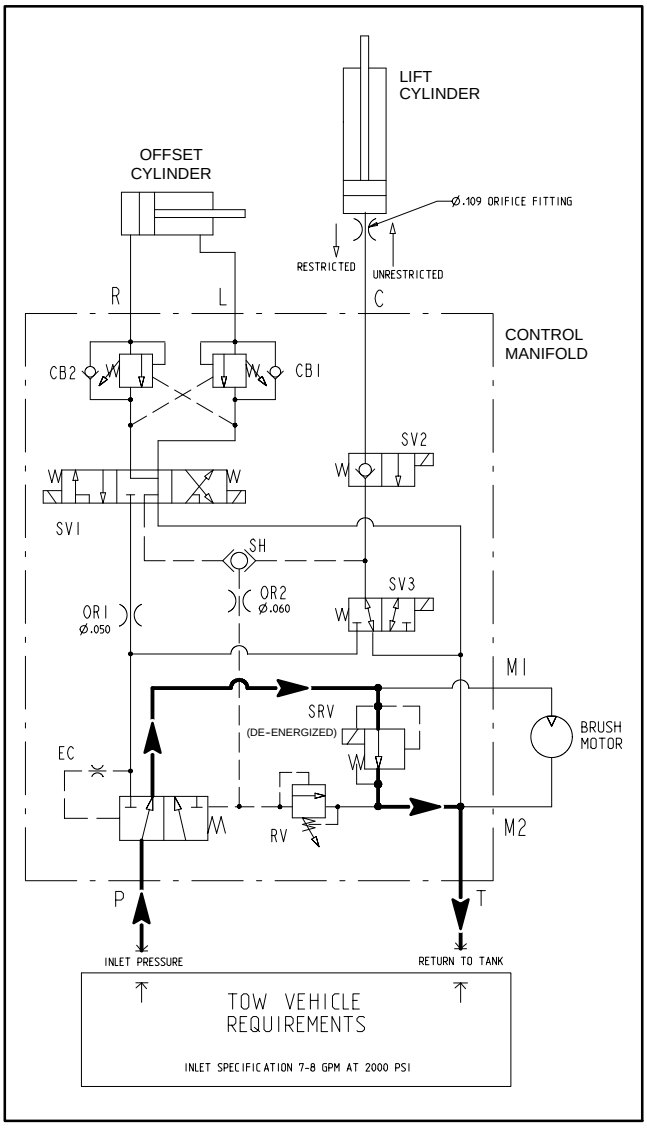
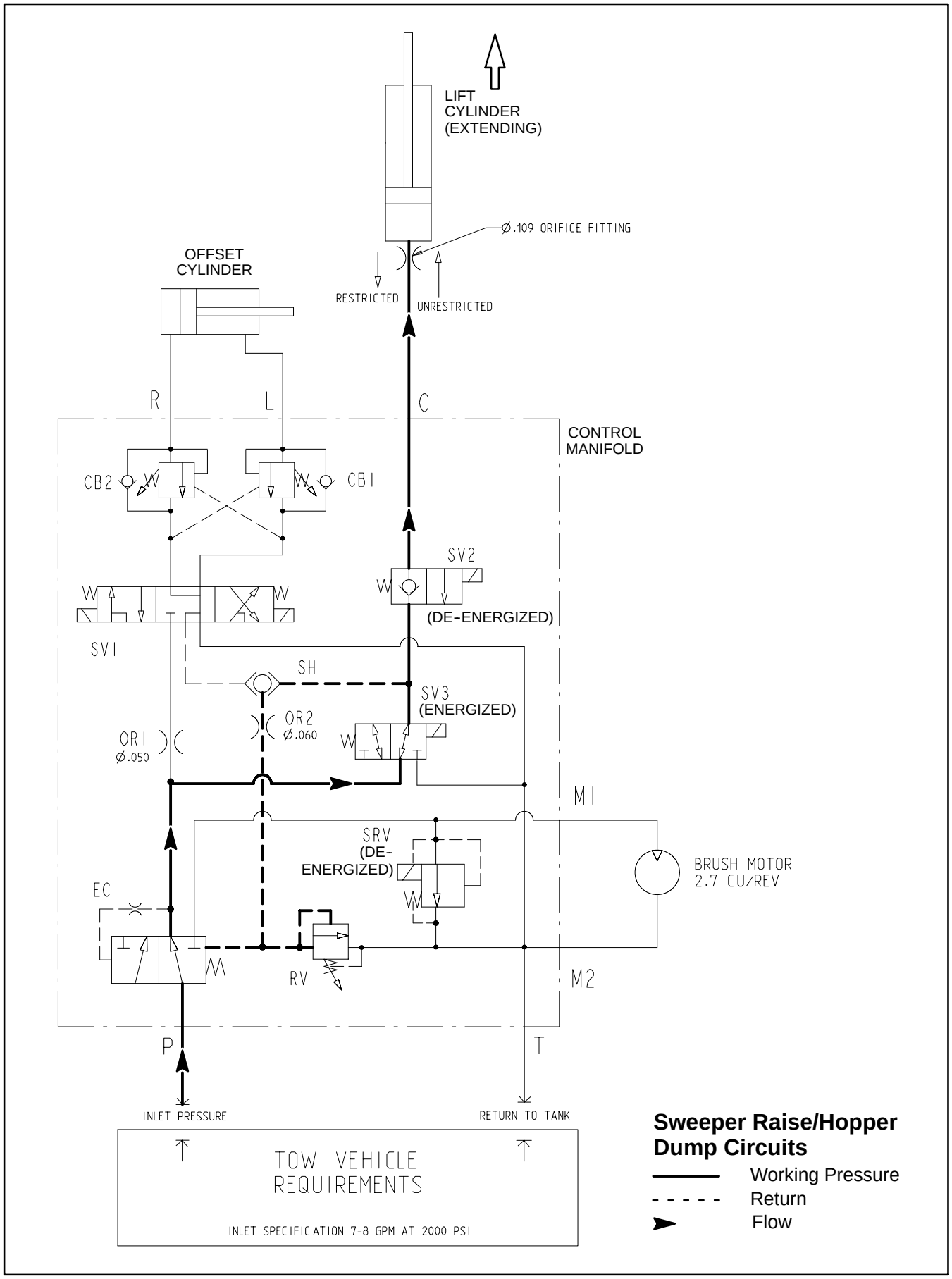


Figure 9


LIFT
CYLINDER
(EXTENDING)
Ø.109 ORIFICE FITTING
OFFSET
CYLINDER
RESTRICTED
UNRESTRICTED
R
L
C
CONTROL
MANIFOLD
CB2
CB1
SV2
(DE-ENERGIZED)
SV1
SH
SV3
(ENERGIZED)
OR2
Ø.060
OR1
Ø.050
M1
SRV
(DE-
ENERGIZED)
BRUSH MOTOR
2.7 CU/REV
EC
RV
M2
P
T
INLET PRESSURE
RETURN TO TANK
TOW VEHICLE
REQUIREMENTS
INLET SPECIFICATION 7-8 GPM AT 2000 PSI
Sweeper Raise/Hopper
Dump Circuits
Working Pressure
Return
Flow

Sweeper Raise/Hopper Dump Circuits

NOTE: Hydraulic flow and relief pressure to the Pro Sweep are determined by the tow vehicle.

When the tow vehicle hydraulics are engaged for the sweeper, hydraulic flow from the tow vehicle goes to the sweeper control manifold (port P) through the hydraulic inlet hose. If the sweeper brush motor is not engaged (sweeper is raised above the transport height) and the lift and offset cylinders are stationary, hydraulic flow from the tow vehicle is directed by the control manifold pressure compensator valve EC and the de-energized solenoid valve SRV to return to the tow vehicle through control manifold port T and the return to tank hose (Fig. 10).

Sweeper Raise

When the tow vehicle hydraulics are engaged and the remote transmitter sweeper up button is pressed and held, solenoid valve SV3 in the hydraulic control manifold is energized. The valve shift of SV3 directs oil flow past the check valve in de-energized valve SV2, out of control manifold port C and to the lift cylinder. Hydraulic pressure against the lift cylinder piston extends the cylinder to raise the hopper. The check valve fitting attached to the lift cylinder allows oil flow to bypass the orifice in the fitting for proper lift cylinder extension.

As the hopper is being raised, control manifold relief valve RV functions as a circuit relief valve. If circuit pressure reaches 2000 PSI (138 bar) while the sweeper is being raised, RV will shift to reduce circuit pressure.

When the transmitter sweeper up button is released or when the sweeper gets to transport (sweeper not offset) or turn around (sweeper is offset) height, solenoid valve SV3 in the hydraulic manifold is de-energized, stopping the raise function. The check valve in de-energized valve SV2 prevents oil flow from the lift cylinder so the sweeper remains in the raised position.

Hopper Dump

If the sweeper is in the transport height position (sweeper not offset), the remote transmitter dump sequence is entered and then the hopper dump button is pressed and held, the sweeper hopper will fully raise to empty the hopper. Control manifold solenoid valve SV3 is energized to allow oil flow to the lift cylinder. De-energized valve SV2 and relief valve RV function the same to dump the hopper as during the sweeper raise function.

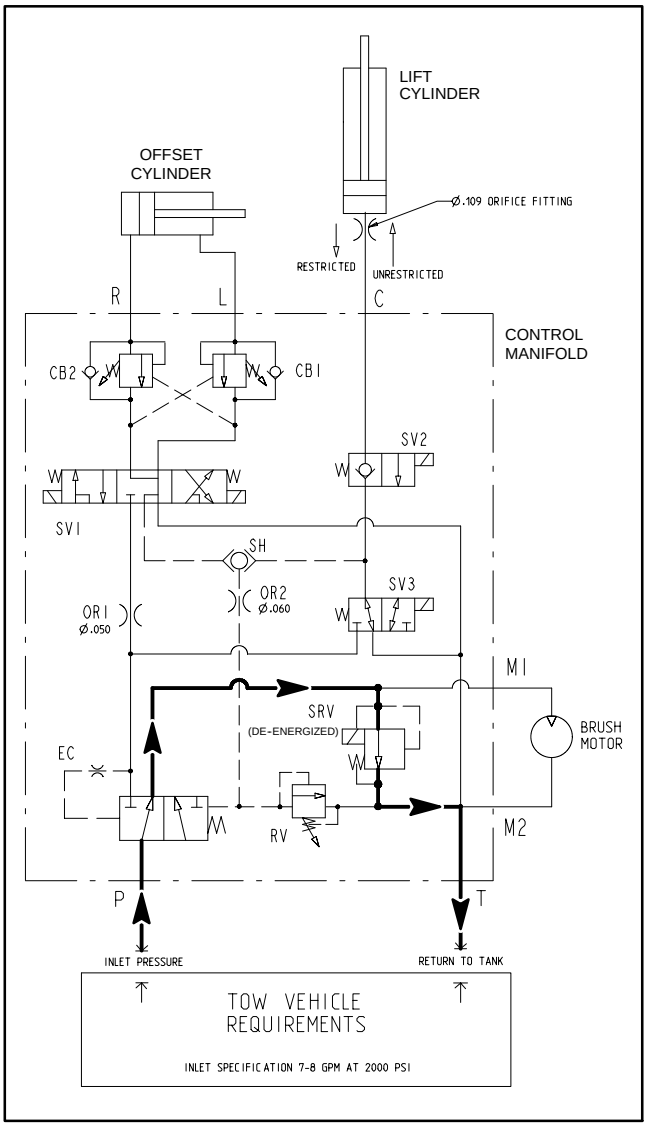
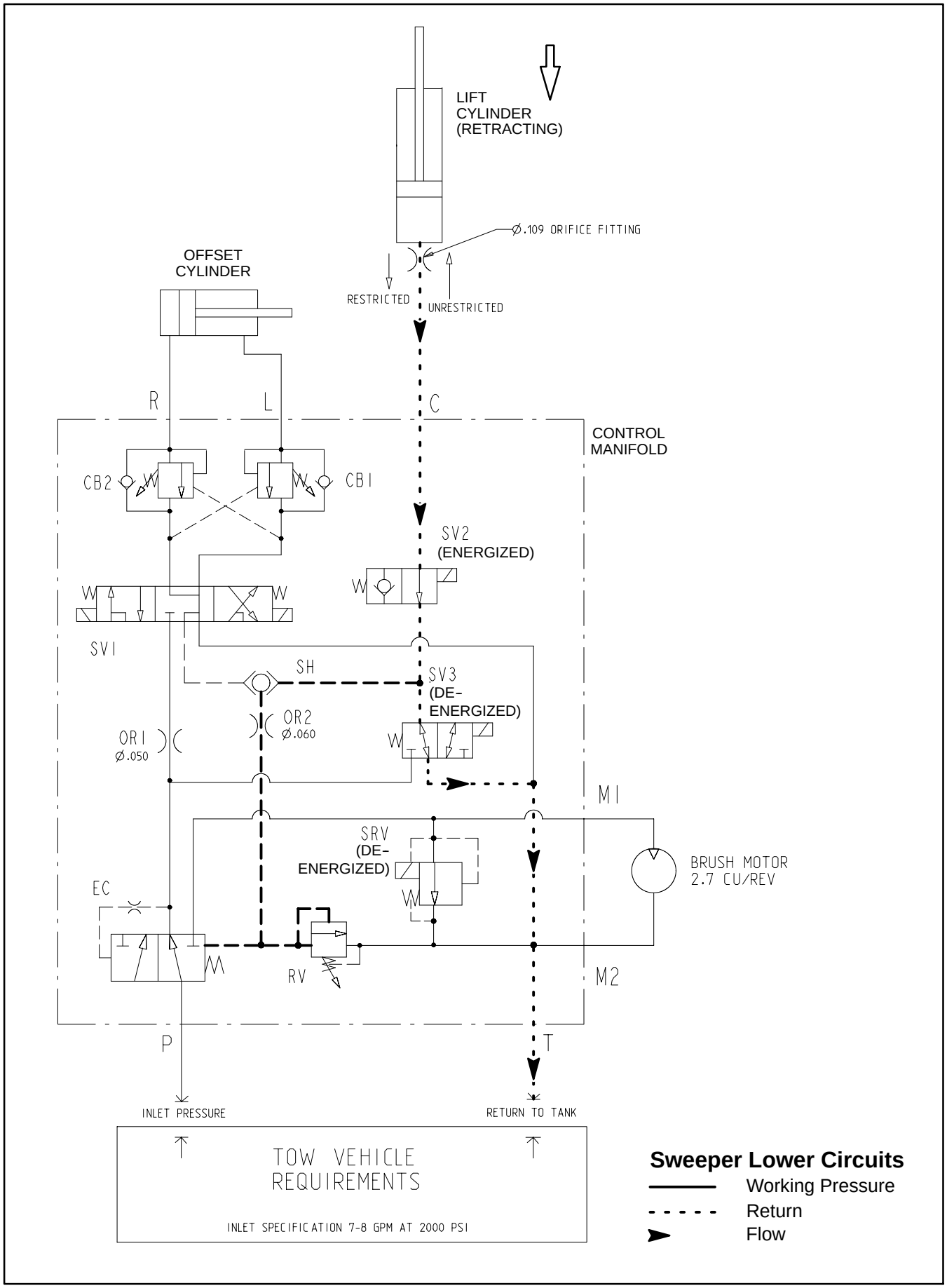


Figure 10


LIFT
CYLINDER
(RETRACTING)
Ø.109 ORIFICE FITTING
OFFSET
CYLINDER
RESTRICTED
UNRESTRICTED
R
L
C
CONTROL
MANIFOLD
CB2
CB1
SV2
(ENERGIZED)
SV1
SH
SV3
(DE-
ENERGIZED)
OR2
Ø.060
OR1
Ø.050
M1
SRV
(DE-
ENERGIZED)
BRUSH MOTOR
2.7 CU/REV
EC
RV
M2
P
T
INLET PRESSURE
RETURN TO TANK
TOW VEHICLE
REQUIREMENTS
INLET SPECIFICATION 7-8 GPM AT 2000 PSI
Sweeper Lower Circuits
Working Pressure
Return
Flow

Sweeper Lower Circuits

NOTE: Hydraulic flow and relief pressure to the Pro Sweep are determined by the tow vehicle.

When the tow vehicle hydraulics are engaged for the sweeper, hydraulic flow from the tow vehicle goes to the sweeper control manifold (port P) through the hydraulic inlet hose. If the sweeper brush motor is not engaged (sweeper is raised above the transport height) and the lift and offset cylinders are stationary, hydraulic flow from the tow vehicle is directed by the control manifold pressure compensator valve EC and the de-energized solenoid valve SRV to return to the tow vehicle through control manifold port T and the return to tank hose (Fig. 11).

Sweeper Lower

When the remote transmitter sweeper down button is pressed, solenoid valve SV2 in the hydraulic control manifold is energized. The valve shift of SV2 allows a path for oil flow from the lift cylinder. The weight of the dump hopper and sweeper frame cause the lift cylinder to retract, allowing the sweeper to lower to the ground. The orifice in the lift cylinder check valve fitting restricts oil flow from the cylinder to control lift cylinder retraction speed.

While lowering, if the remote transmitter sweeper up or stop button are pressed, solenoid valve SV2 will de-energize and oil flow from the lift cylinder will cease. The sweeper will stop lowering and remain in position.

As the sweeper is being lowered, relief valve RV functions as a circuit relief valve. If circuit pressure reaches 2000 PSI (138 bar), RV will shift to reduce circuit pressure.

Sweeper Float

After the sweeper has been fully lowered to the ground, solenoid valve SV2 will continue to be energized. The shifted valve will allow lift cylinder and sweeper movement so the sweeper head can follow ground surface contours.

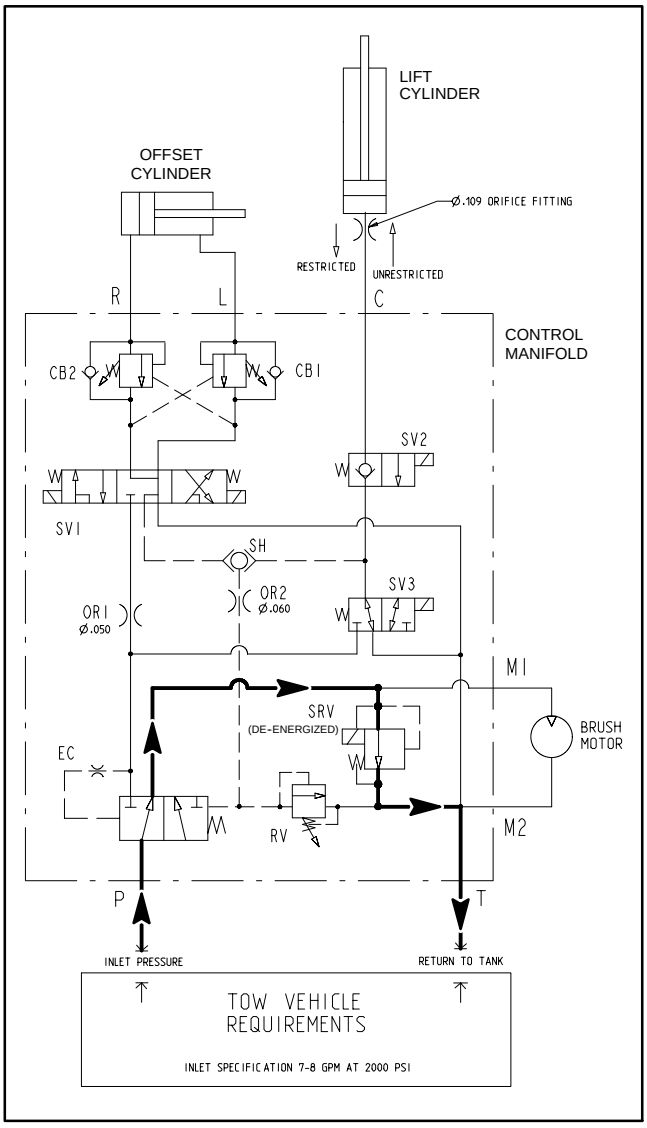
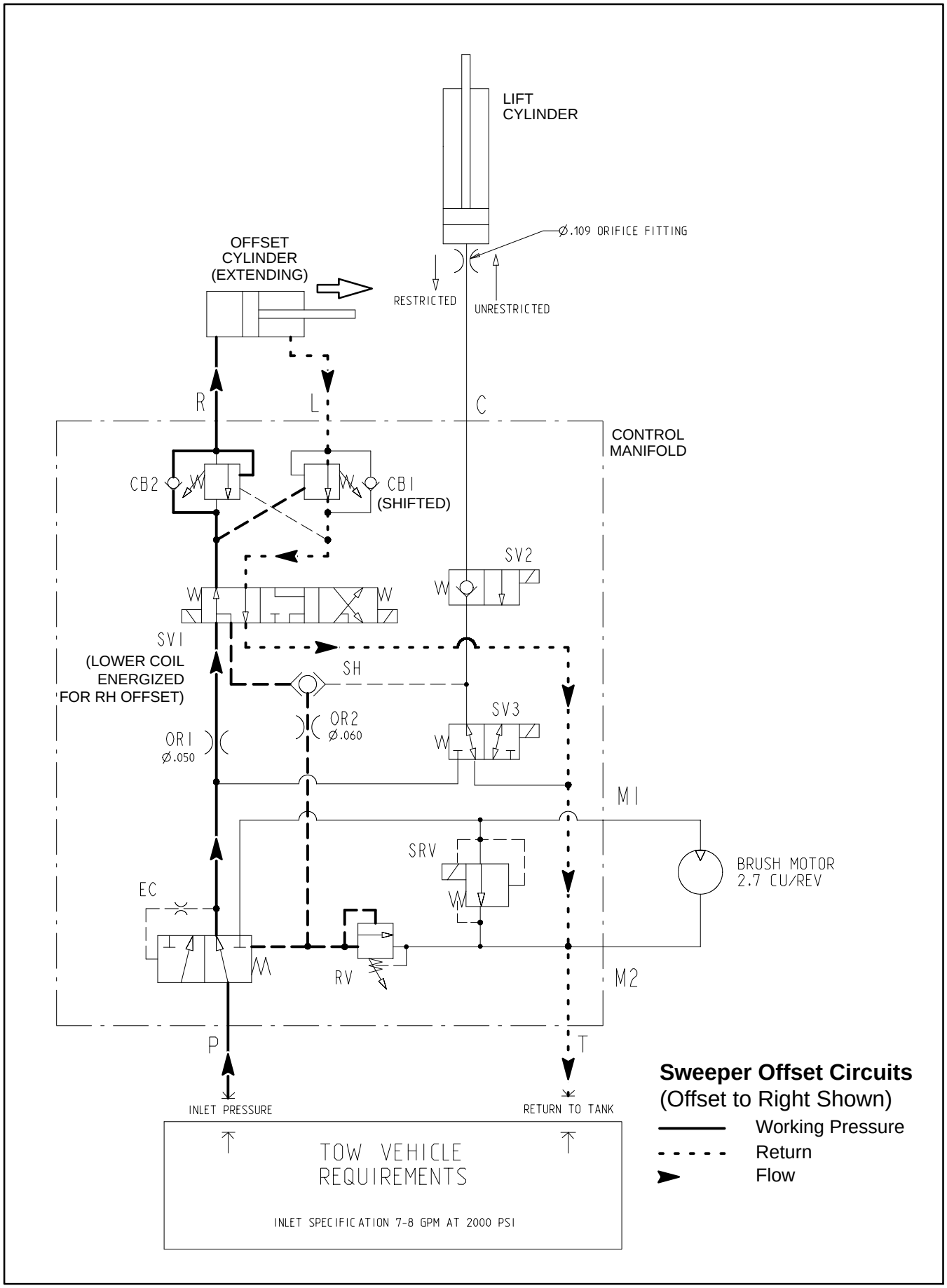


Figure 11


LIFT
CYLINDER
Ø.109 ORIFICE FITTING
OFFSET
CYLINDER
(EXTENDING)
RESTRICTED
UNRESTRICTED
R
L
C
CONTROL
MANIFOLD
CB2
CB1
(SHIFTED)
SV2
SV1
(LOWER COIL
ENERGIZED
FOR RH OFFSET)
SH
OR2
Ø.060
SV3
OR1
Ø.050
M1
SRV
BRUSH MOTOR
2.7 CU/REV
EC
RV
M2
P
T
INLET PRESSURE
RETURN TO TANK
TOW VEHICLE
REQUIREMENTS
INLET SPECIFICATION 7-8 GPM AT 2000 PSI
Sweeper Offset Circuits
(Offset to Right Shown)
Working Pressure
Return
Flow

Sweeper Offset Circuits

NOTE: Hydraulic flow and relief pressure to the Pro Sweep are determined by the tow vehicle.

When the tow vehicle hydraulics are engaged for the sweeper, hydraulic flow from the tow vehicle goes to the sweeper control manifold (port P) through the hydraulic inlet hose. If the sweeper brush motor is not engaged (sweeper is raised above the transport height) and the lift and offset cylinders are stationary, hydraulic flow from the tow vehicle is directed by the control manifold pressure compensator valve EC and the de-energized solenoid valve SRV to return to the tow vehicle through control manifold port T and the return to tank hose (Fig. 12).

Offset Right

When the remote transmitter offset right button is pressed and held, the lower coil for solenoid valve SV1 in the hydraulic control manifold will be energized. If the tow vehicle hydraulics are engaged for the sweeper, the shifted SV1 allows a path for oil flow to the barrel end of the offset cylinder.

Oil flow through shifted SV1 is directed through the check valve in counterbalance valve CB2, out of control manifold port R and to the barrel end of the offset cylinder. As circuit pressure increases, a manifold sensing line shifts counterbalance cartridge CB1 to allow a return path for oil from the rod end of the offset cylinder. The offset cylinder will extend to cause the sweeper to offset to the right. Oil from the rod end of the offset cylinder returns to the tow vehicle through shifted SV1, control manifold port T and the return to tank hose.

Orifice OR1 (0.050) in the control manifold exists to control the extending speed of the offset cylinder.

As the sweeper is being offset, relief valve RV functions as a circuit relief valve. If circuit pressure reaches 2000 PSI (138 bar), RV will shift to reduce circuit pressure.

When the transmitter offset right button is released, the lower coil for solenoid valve SV1 will de-energize and oil flow to the offset cylinder will cease. The sweeper will remain in position.

Offset Left

When the remote transmitter offset left button is pressed and held, the upper coil for solenoid valve SV1 in the hydraulic control manifold will be energized. If the tow vehicle hydraulics are engaged for the sweeper, the shifted SV1 allows a path for oil flow to the rod end of the offset cylinder.

Oil flow through shifted SV1 is directed through the check valve in counterbalance valve CB1, out of control manifold port L and to the rod end of the offset cylinder. As circuit pressure increases, a manifold sensing line shifts counterbalance cartridge CB2 to allow a return path for oil from the barrel end of the offset cylinder. The offset cylinder will retract to cause the sweeper to offset to the left. Oil from the barrel end of the offset cylinder returns to the tow vehicle through shifted SV1, control manifold port T and the return to tank hose.

Control manifold orifice OR1 (0.050) and relief valve RV function the same in offset left as during offset right.

When the transmitter offset left button is released, the upper coil for solenoid valve SV1 will de-energize and oil flow to the offset cylinder will cease. The sweeper will remain in position.

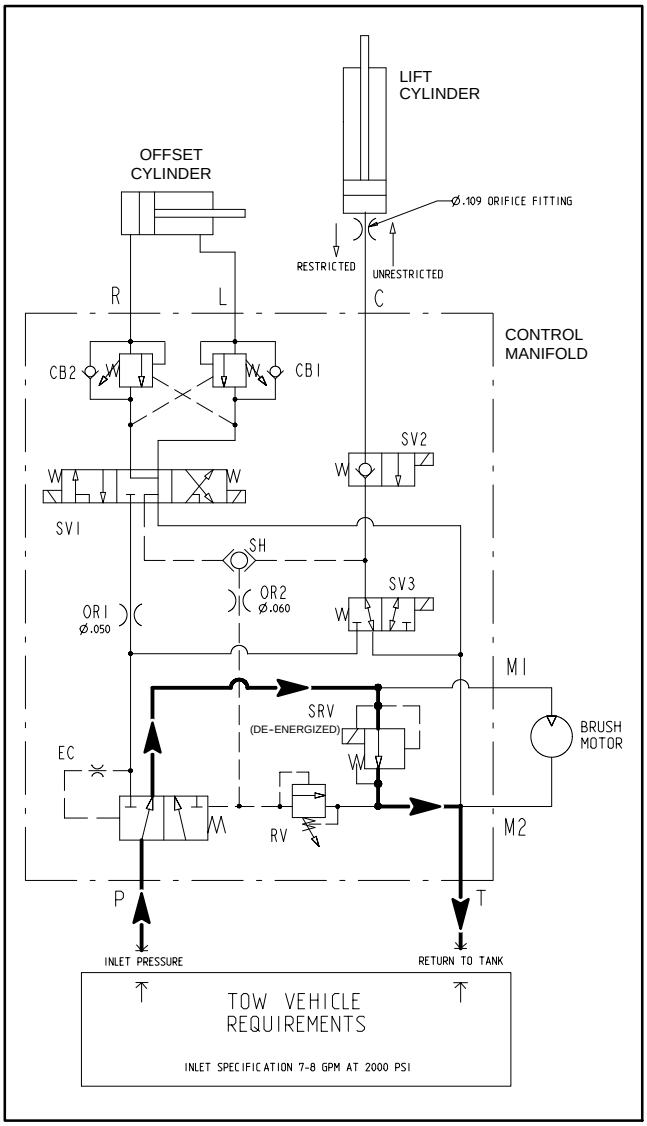


Figure 12

Troubleshooting

The cause of an improperly functioning hydraulic system is best diagnosed with the use of proper testing equipment and a thorough understanding of the complete hydraulic system.

A hydraulic system with an excessive increase in heat or noise has a potential for failure. Should either of these conditions be noticed, immediately stop the machine, turn off the engine of the tow vehicle, locate the cause of the trouble and correct it before allowing the machine to be used again. Continued use of an improperly functioning hydraulic system could lead to extensive hydraulic component damage.

The charts that follow contain information to assist in troubleshooting. There may possibly be more than one cause for a machine malfunction.

The successful operation of the Pro Sweep depends on the hydraulic system of the tow vehicle. When troubleshooting a sweeper hydraulic problem, make sure that the tow vehicle hydraulic system is evaluated as well.

NOTE: When troubleshooting a hydraulic problem on the Pro Sweep, inspect tow vehicle hydraulic system if sweeper brush motor, offset cylinder and lift cylinder are all malfunctioning. If one sweeper hydraulic circuit appears to be malfunctioning (e.g. the brush circuit and lift cylinder are working but the offset cylinder will not function), check the non–functioning circuit and its components.

Problem	Possible Cause
Hydraulic oil leaks.	Hydraulic fitting(s) or hose(s) are loose or damaged. O–ring(s) or seal(s) are missing or damaged.
Foaming hydraulic fluid.	Hydraulic oil level in tow vehicle reservoir is low. Hydraulic system has wrong kind of oil. Hydraulic system on tow vehicle is malfunctioning.
Hydraulic system operates hot.	Hydraulic oil level in tow vehicle reservoir is low. Excessive dirt and debris on Pro Sweep hydraulic components. Hydraulic oil is contaminated or too light. Brush motor is worn or damaged. Hydraulic system on tow vehicle is malfunctioning.

Problem	Possible Cause
Brush motor will not turn.	Control module has gone to time–out due to inactivity of remote transmitter. Sweeper is raised above transport height. Hydraulic hose(s) to tow vehicle are not connected (lift cylinder and offset cylinder affected as well). Tow vehicle hydraulics are not engaged to Pro Sweep (lift and offset cylinders affected as well). An electrical problem exists that prevents SRV solenoid coil on control manifold from being energized (see Troubleshooting in Chapter 4 – Electrical System). Control manifold SRV solenoid cartridge is faulty. Control manifold EC cartridge is faulty. Hydraulic brush motor is faulty. An electrical problem exists that prevents operation of control module or remote transmitter.

Problem	Possible Cause
Sweeper will not lift or lifts slowly.	Control module has gone to time–out due to inactivity of remote transmitter. Hydraulic hose(s) to tow vehicle are not connected (brush motor and offset cylinder affected as well). Tow vehicle hydraulics are not engaged to Pro Sweep (brush motor and offset cylinder affected as well). Hydraulic oil level in tow vehicle reservoir is low. Lift cylinder is binding. Sweeper frame components are binding. Check valve fitting on lift cylinder is faulty. An electrical problem exists that prevents control manifold solenoid coil SV3 from being energized (see Troubleshooting in Chapter 4 – Electrical System). Control manifold solenoid cartridge SV3 is faulty. Control manifold solenoid cartridge SV2 is faulty. Control manifold relief valve RV is leaking or faulty. Control manifold cartridge EC is faulty. Hydraulic system on tow vehicle is malfunctioning (brush motor and offset cylinder affected as well). An electrical problem exists that prevents operation of control module or remote transmitter (see Troubleshooting in Chapter 4 – Electrical System). Lift cylinder is damaged.

Problem	Possible Cause
Sweep hopper will not dump.	Remote transmitter dump sequence not followed. Control module has gone to time–out due to inactivity of remote transmitter. Sweeper is in the offset position. Sweeper not in transport height when remote transmitter dump sequence was entered. Hydraulic hose(s) to tow vehicle are not connected (brush motor and offset cylinder affected as well). Tow vehicle hydraulics are not engaged to Pro Sweep (brush motor and offset cylinder affected as well). Hydraulic oil level in tow vehicle reservoir is low. Lift cylinder is binding. Sweeper frame components are binding. Check valve fitting on lift cylinder is faulty. An electrical problem exists that prevents control manifold solenoid coil SV3 from being energized (see Troubleshooting in Chapter 4 – Electrical System). Control manifold solenoid cartridge SV3 is faulty. Control manifold solenoid cartridge SV2 is faulty. Control manifold relief valve RV is leaking or faulty. Control manifold cartridge EC is faulty. Hydraulic system on tow vehicle is malfunctioning (brush motor and offset cylinder affected as well). An electrical problem exists that prevents operation of control module or remote transmitter (see Troubleshooting in Chapter 4 – Electrical System). Lift cylinder is damaged.
Sweeper raises, but will not stay up. **NOTE:** Control manifold cartridge cannot provide an absolutely perfect seal. The dump hopper may eventually lower if left in the raised position. Use lift cylinder safety support when dump hopper is raised.	Control manifold SV2 cartridge is leaking or faulty.

Problem	Possible Cause
Sweeper will not move to or from the offset position.	Control module has gone to time–out due to inactivity of remote transmitter. Hydraulic hose(s) to tow vehicle are not connected (brush motor and lift cylinder affected as well). Tow vehicle hydraulics are not engaged to Pro Sweep (brush motor and lift cylinder affected as well). Sweeper is raised above transport height. Offset cylinder is binding. Sweeper frame components are binding. An electrical problem exists that prevents coil on control manifold solenoid valve SV1 from being energized (see Troubleshooting in Chapter 4 – Electrical System). Control manifold solenoid cartridge SV1 is faulty. Control manifold cartridge CB1 and/or CB2 are faulty. Offset cylinder is damaged. An electrical problem exists that prevents operation of control module or remote transmitter (see Troubleshooting in Chapter 4 – Electrical System).

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General Precautions for Removing and Installing Hydraulic System Components

Before Repair or Replacement of Components

1. Before removing any parts from the hydraulic system, empty sweeper hopper and position sweeper on a level surface. Chock sweeper wheels to prevent sweeper from moving. If sweeper is attached to tow vehicle, apply tow vehicle parking brake, stop engine and remove key from the ignition switch.

2. Clean machine before disconnecting, removing or disassembling any hydraulic components. Make sure hydraulic components, hoses, connections and fittings are thoroughly cleaned. Always keep in mind the need for cleanliness when working on hydraulic equipment.

CAUTION

Before disconnecting any hydraulic components, operate all sweeper hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil. See Relieving Hydraulic System Pressure in the General Information section of this chapter.

3. Put caps or plugs on any hydraulic lines, hydraulic fittings or hydraulic components left open or exposed to prevent hydraulic system contamination.

4. Put labels on disconnected hydraulic hoses for proper installation after repairs are completed.

5. Note the position of hydraulic fittings (especially elbow fittings) on hydraulic components before removal. Mark parts if necessary to make sure they will be aligned properly when reinstalling hydraulic hoses.

After Repair or Replacement of Components

1. If component failure was severe or if hydraulic system is contaminated, drain entire hydraulic system. Drain and flush all hoses and components. Also, drain and refill tow vehicle hydraulic system reservoir and change oil filter.

2. Lubricate O–rings and seals with clean hydraulic oil before installing hydraulic components.

3. Make sure caps or plugs are removed from the hydraulic lines, hydraulic fittings and components before reconnecting.

4. Use proper tightening methods when installing hydraulic hoses and fittings (see Hydraulic Fitting Installation in the General Information section of this chapter).

5. After repairs are completed but before operating the sweeper, check oil level in the hydraulic reservoir of the tow vehicle and add correct oil if necessary.

6. After disconnecting or replacing any hydraulic components, operate machine functions slowly until air is out of system.

7. Check for hydraulic oil leaks. Shut off tow vehicle engine and correct leaks if any are discovered. Check oil level in hydraulic reservoir and add correct oil if necessary.

Check Hydraulic Lines and Hoses

WARNING

Keep body and hands away from pin hole leaks or nozzles that eject hydraulic fluid under high pressure. Use paper or cardboard, not hands, to search for leaks. Hydraulic fluid escaping under pressure can have sufficient force to penetrate the skin and cause serious injury. If fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type of injury. Gangrene may result from such an injury.

Before using sweeper, check hydraulic hoses for leaks, kinked lines, loose mounting supports, wear, loose fittings or any other deterioration. Make all necessary repairs before operating sweeper.

Brush Motor

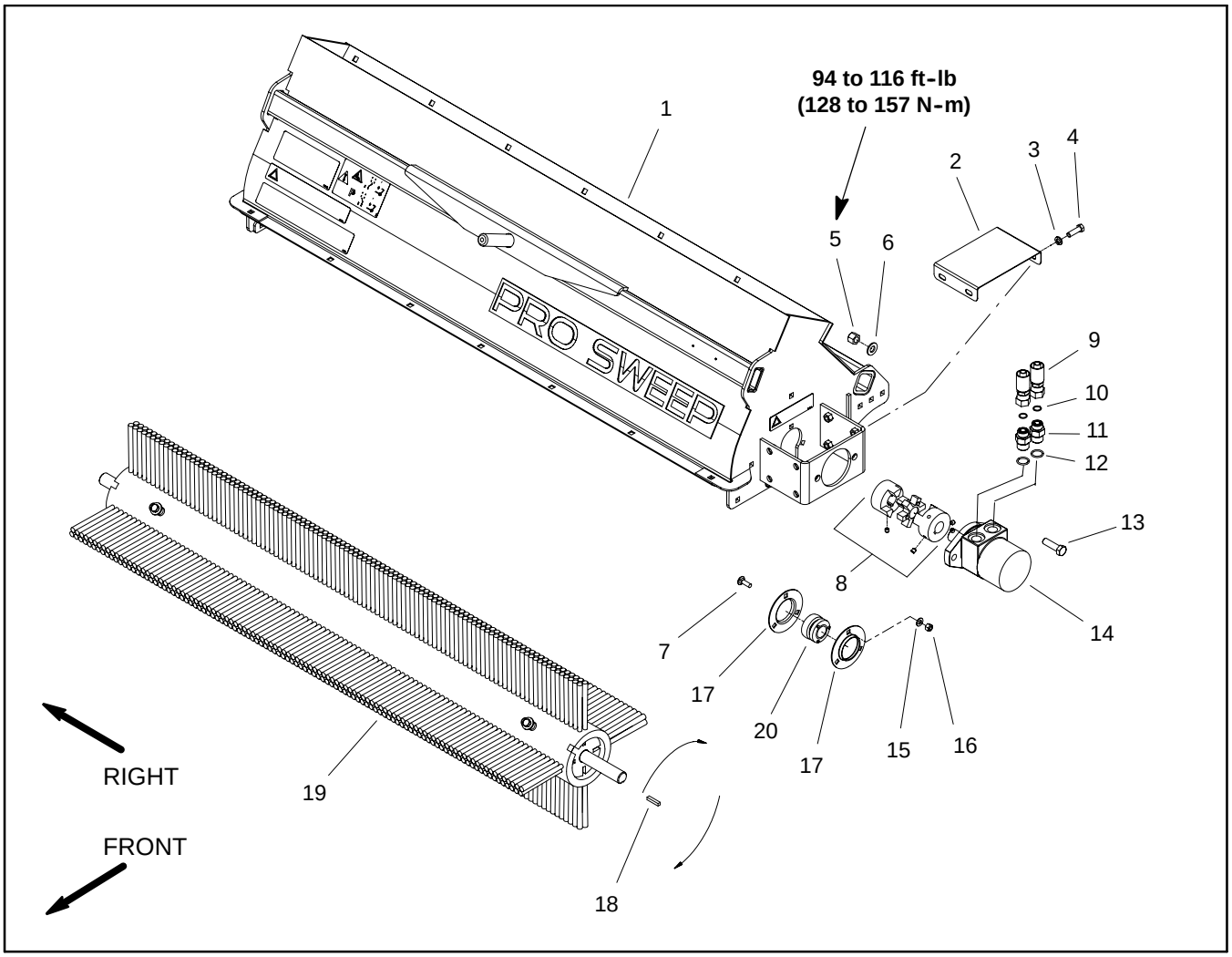

Figure 13

1. **Brush housing**
2. **Coupling cover (2 used)**
3. **Lock washer (8 used)**
4. **Cap screw (8 used)**
5. **Lock nut (2 used)**
6. **Flat washer (2 used)**
7. **Carriage bolt (6 used)**
8. **Coupling assembly**
9. **Hydraulic hose (2 used)**
10. **O-ring (2 used)**
11. **Hydraulic fitting (2 used)**
12. **O-ring (2 used)**
13. **Cap screw (2 used)**
14. **Hydraulic brush motor**
15. **Flat washer (6 used)**
16. **Lock nut (6 used)**
17. **Bearing flange (4 used)**
18. **Square key**
19. **Brush assembly**
20. **Bearing assembly**

Removal (Fig. 13)

1. Position sweeper on a level surface with dump hopper empty and fully lowered. Chock sweeper wheels to prevent sweeper from moving. If sweeper is attached to tow vehicle, apply tow vehicle parking brake, stop engine and remove key from the ignition switch.

CAUTION

Before disconnecting any hydraulic components, operate all sweeper hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil. See Relieving Hydraulic System Pressure in the General Information section of this chapter.

2. Relieve sweeper hydraulic system pressure.

3. Clean brush motor and hydraulic connections. Label hydraulic lines for assembly purposes.

4. Disconnect hydraulic hoses from hydraulic fittings on brush motor. Allow hydraulic oil to drain from lines into a suitable container. Put caps or plugs on open hydraulic lines and fittings to prevent contamination.

5. Remove upper coupling cover from brush housing.

6. Support brush motor. Remove two (2) cap screws (item 13), flat washers (item 6) and lock nuts (item 5) that secure motor to frame. Pull brush motor (with coupling jaw attached) from the machine.

IMPORTANT: To prevent damage to hydraulic motor, DO NOT hit coupling jaw or motor with a hammer during coupling jaw removal or installation.

7. Loosen set screw that secures coupling jaw to brush motor shaft. Use puller to remove coupling jaw from motor shaft. Locate and retrieve woodruff key from motor shaft.

8. If required, remove hydraulic fittings and O-rings from the wheel motor. Discard O-rings.

Installation (Fig. 13)

1. If removed, install hydraulic fittings with new O-rings into the brush motor ports (see Hydraulic Fitting Installation in the General Information section of this chapter).

2. If coupling jaw was removed from motor, apply antiseize lubricant to motor shaft. Position woodruff key into shaft keyway and slide coupling jaw onto shaft. Make sure that coupling spider is positioned into coupling jaw on brush shaft.

3. Align coupling jaw on motor shaft with coupling spider. Position and support brush motor to the frame.

4. Align motor shaft with brush shaft. Secure brush motor to frame with two (2) cap screws (item 13), flat washers (item 6) and lock nuts (item 5). Torque lock nuts from **94 to 116 ft-lb (128 to 157 N-m)**.

5. Position coupling jaw on motor shaft to allow a gap between coupler jaw valleys from 0.830" to 0.930" (21.1 to 23.6 mm) (Fig. 15). Apply Loctite #242 (or equivalent) to threads of coupling set screw. Secure coupling jaw to motor shaft by torquing set screw from **61 to 85 in-lb (6.9 to 9.6 N-m)**.

6. Remove all caps or plugs that were placed on hydraulic lines and fittings during disassembly.

7. Using labels placed during motor removal, correctly install hydraulic hoses to hydraulic fittings on brush motor. Tighten connections (see Hydraulic Hose and Tube Installation in the General Information section of this chapter).

8. Install upper coupling cover to brush housing.

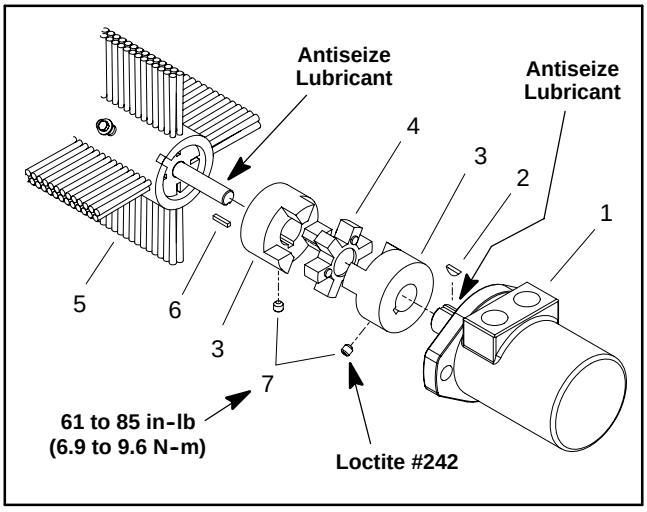

Figure 14

1. Hydraulic brush motor
2. Woodruff key
3. Coupling jaw
4. Coupling spider
5. Brush assembly
6. Square key
7. Set screw

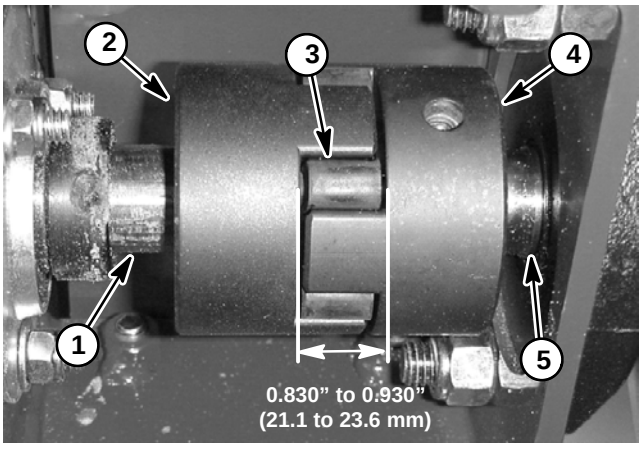

Figure 15

1. Brush shaft
2. Brush coupling jaw
3. Coupling spider
4. Motor coupling jaw
5. Motor shaft

Brush Motor Service

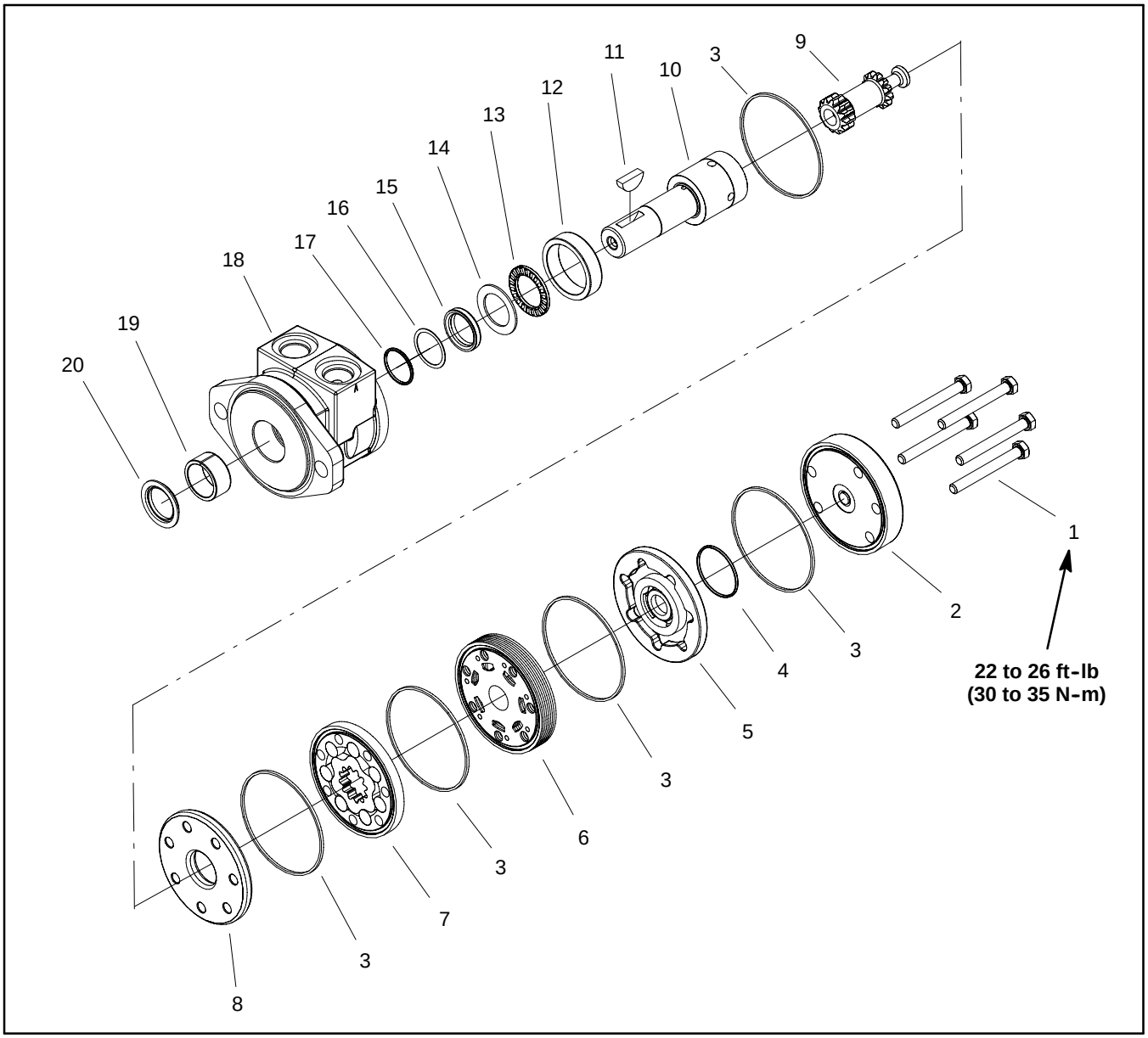

Figure 16

1. **Cap screw (5 used)**
2. **End cover**
3. **Ring seal**
4. **Commutator seal**
5. **Commutator and ring assembly**
6. **Manifold**
7. **Stator**
8. **Wear plate**
9. **Drive link**
10. **Coupling shaft**
11. **Woodruff key**
12. **Bushing**
13. **Thrust bearing**
14. **Thrust washer**
15. **Inner seal**
16. **Backup washer**
17. **O-ring**
18. **Housing**
19. **Bearing**
20. **Seal**

NOTE: For service of the hydraulic brush motor, see the Parker Torqlink™ Service Procedure at the end of this chapter.

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Hydraulic Control Manifold

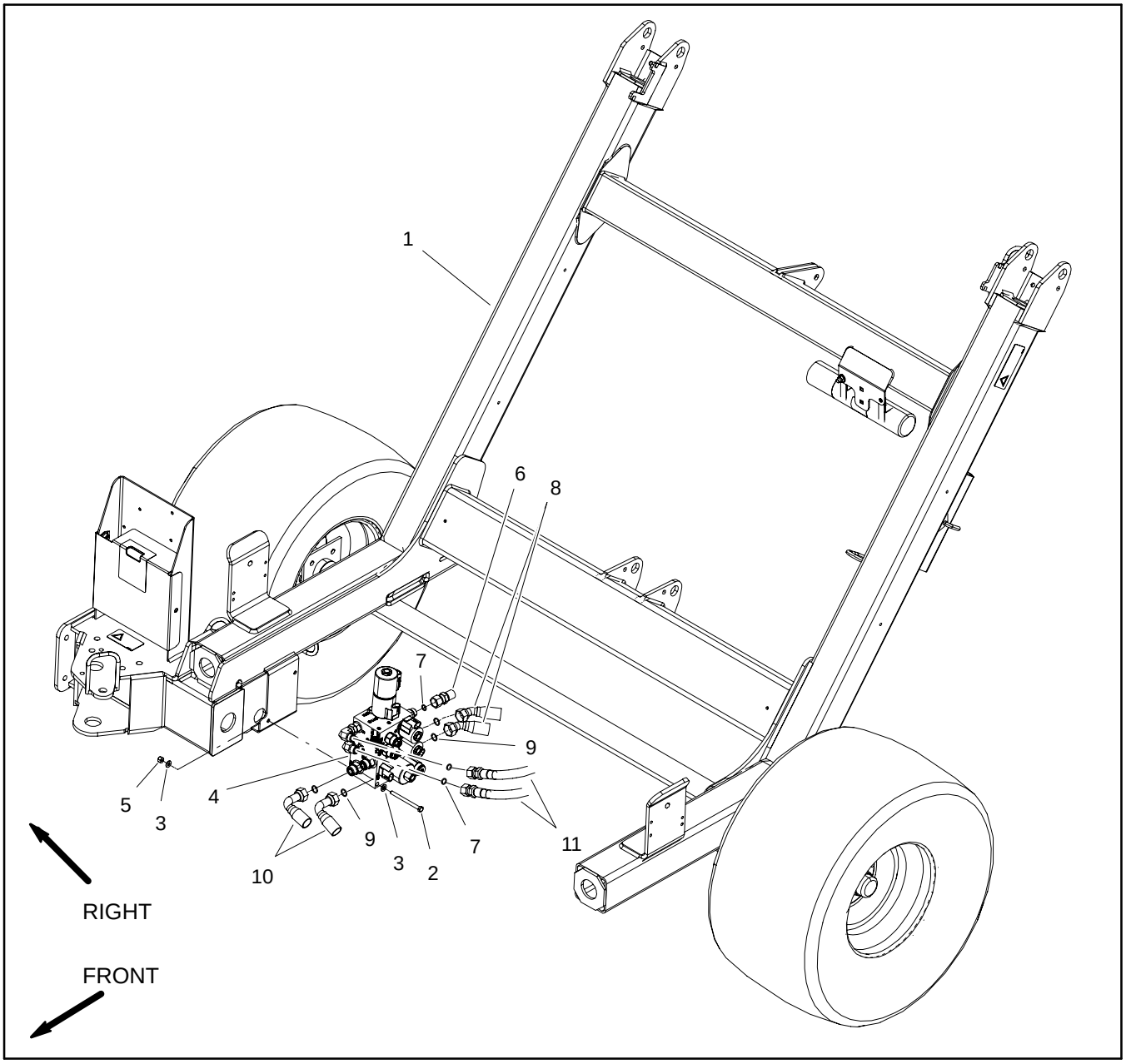

Figure 17

1. **Main frame**
2. **Cap screw (2 used)**
3. **Flat washer (4 used)**
4. **Hydraulic control manifold**
5. **Lock nut (2 used)**
6. **Hydraulic hose**
7. **O-ring**
8. **Hydraulic hose (2 used)**
9. **O-ring**
10. **Hydraulic hose (2 used)**
11. **Hydraulic hose (2 used)**

Removal (Fig. 17)

1. Position sweeper on a level surface with dump hopper empty and fully lowered. Chock sweeper wheels to prevent sweeper from moving. If sweeper is attached to tow vehicle, apply tow vehicle parking brake, stop engine and remove key from the ignition switch.

CAUTION

Before disconnecting any hydraulic components, operate all sweeper hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil. See Relieving Hydraulic System Pressure in the General Information section of this chapter.

2. Relieve sweeper hydraulic system pressure.

3. Thoroughly clean control manifold and manifold hydraulic connections.

NOTE: The ports on the control manifold are marked to identify hydraulic hose connections. Example: P is the pump connection port (see Hydraulic Schematic in this chapter to identify the function of the hydraulic lines and cartridge valves at each manifold port location).

4. Label all control manifold electrical and hydraulic connections for assembly purposes.

5. Disconnect wire harness electrical connectors from solenoid valves on control manifold.

6. Disconnect hydraulic hoses from manifold fittings.

7. Allow disconnected hydraulic hoses to drain into a suitable container. Put caps or plugs on disconnected hoses and fittings to prevent contamination. Discard any removed O−rings.

8. Support control manifold to prevent it from falling. Remove two (2) cap screws, flat washers and lock nuts that secure hydraulic manifold to the frame mounting bracket.

9. Remove hydraulic manifold from the machine.

10. Remove hydraulic fittings from manifold as needed (Fig. 18). Discard any removed O−rings.

Installation (Fig. 17)

1. Lightly oil new O−rings for all removed hydraulic fittings. Install hydraulic fittings to control manifold (see Hydraulic Fitting Installation in the General Information section of this chapter).

2. Position hydraulic manifold to the frame mounting bracket. Install cap screws, washers and lock nuts that secure manifold to frame. Do not fully tighten fasteners.

3. Make sure all hydraulic connections, ports and fittings are clean.

4. Remove caps or plugs that were put on hydraulic hoses and fittings during manifold removal.

5. Lightly oil new O−rings for hydraulic fitting and hose locations and install O−rings in fitting.

6. Using labels placed during manifold removal, correctly connect hydraulic hoses to the manifold fittings. Properly tighten all hydraulic connections (see Hydraulic Hose and Tube Installation in the General Information section of this chapter).

7. Secure hydraulic manifold to machine by tightening cap screws and lock nuts.

8. Using labels placed during manifold removal, connect wire harness electrical connectors to solenoid valves on control manifold.

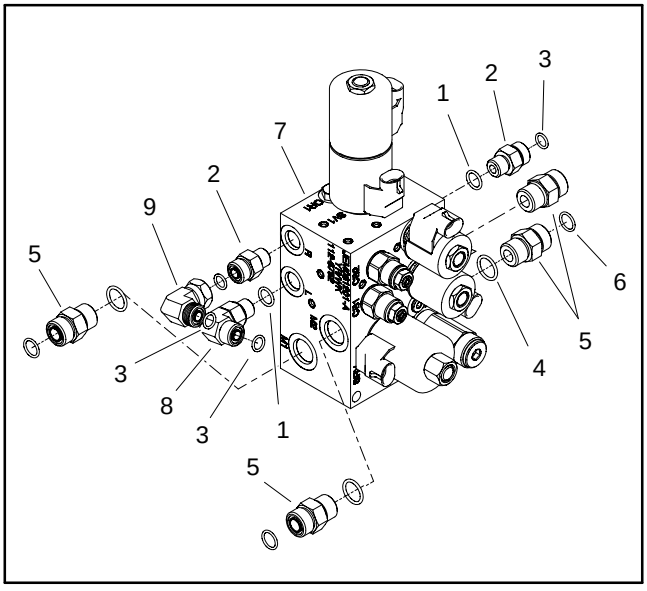

Figure 18

1. **O−ring**
2. **Hydraulic fitting**
3. **O−ring**
4. **O−ring**
5. **Hydraulic fitting**
6. **O−ring**
7. **Hydraulic manifold**
8. **90° hydraulic fitting**
9. **90° hydraulic fitting**

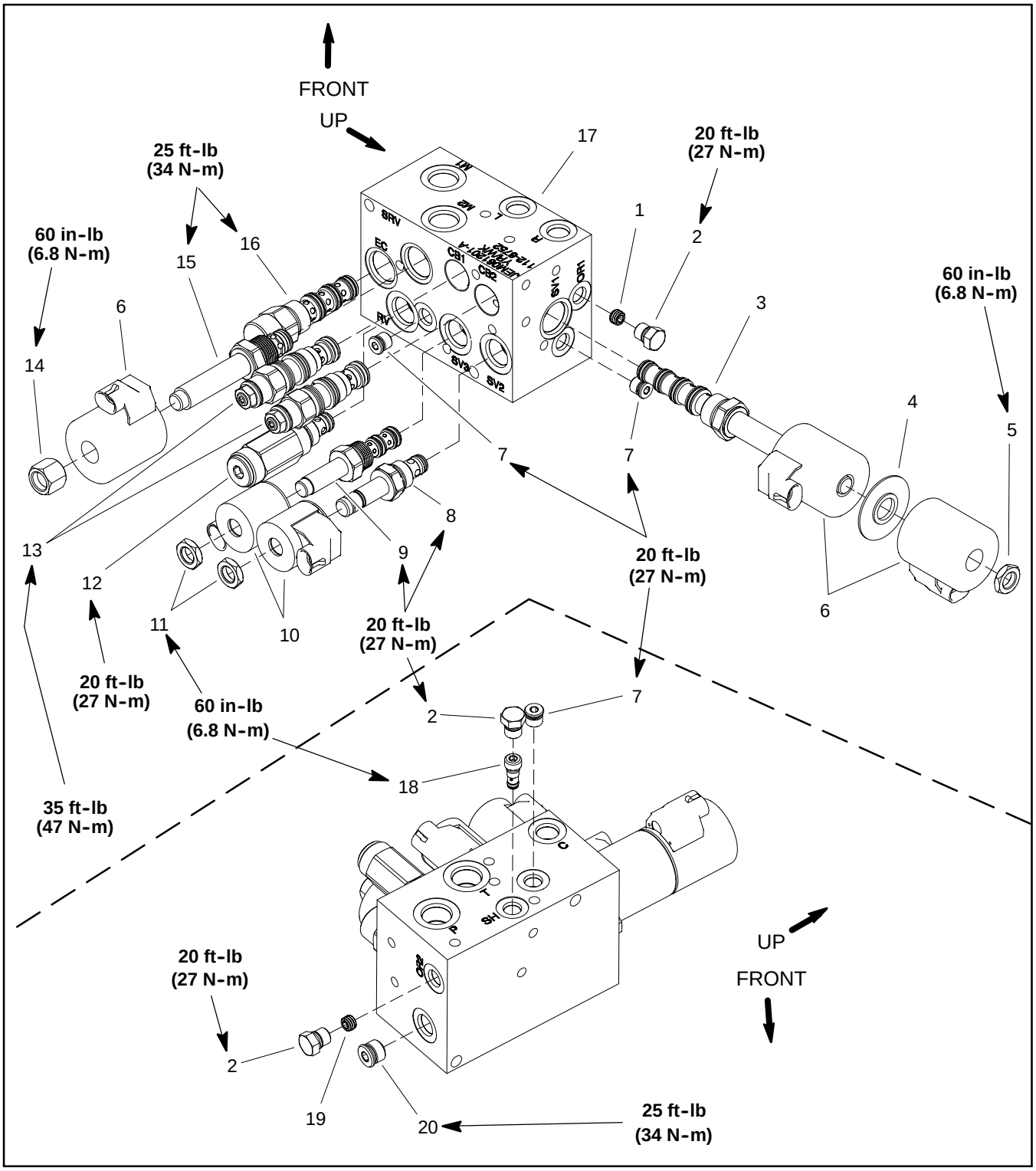

Figure 19

1. Orifice (0.050) (OR1)
2. #4 zero leak plug
3. Solenoid valve (SV1)
4. Coil spacer
5. Nut
6. Solenoid coil
7. #4 zero leak plug
8. Solenoid valve (SV2)
9. Solenoid valve (SV3)
10. Solenoid coil
11. Nut
12. Relief valve (RV)
13. Counterbalance valve (CB1 & CB2)
14. Nut
15. Solenoid relief valve (SRV)
16. Pressure compensator valve (EC)
17. Hydraulic manifold
18. Shuttle valve (SH)
19. Orifice (0.060) (OR2)
20. #6 zero leak plug

NOTE: The ports on the manifold are marked for easy identification of components. Examples: P is the pump connection port and OR2 is the location for an orifice (See Hydraulic Schematic to identify the function of the hydraulic lines and cartridge valves at each port).

Hydraulic Manifold Service (Fig. 19)

1. Make sure the control manifold is clean before removing any cartridge valve.

2. If solenoid cartridge is being serviced, remove nut securing solenoid to the cartridge valve. Carefully slide solenoid off the valve.

CAUTION

Before disconnecting any hydraulic components, operate all sweeper hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil. See Relieving Hydraulic System Pressure in the General Information section of this chapter.

WARNING

If control manifold is attached to sweeper, make sure that sweeper is fully lowered before loosening hydraulic lines, cartridge valves or plugs from control manifold. If sweeper is not fully lowered as manifold components are loosened, sweeper may drop unexpectedly.

IMPORTANT: Use care when handling the cartridge valve. Slight bending or distortion of the stem tube can cause binding and malfunction.

3. Remove cartridge valve with a deep socket wrench. Note correct location for O−rings, sealing rings and backup rings. Remove and discard seal kit from valve.

4. Visually inspect the manifold port for damage to the sealing surfaces, damaged threads or contamination.

5. Visually inspect cartridge valve for damaged sealing surfaces and contamination.

A. Contamination may cause valves to stick or hang up. Contamination can become lodged in small valve orifices or seal areas causing malfunction.

B. If valve sealing surfaces appear pitted or damaged, the hydraulic system may be overheating or there may be water in the system.

CAUTION

Use eye protection such as goggles when using compressed air for cartridge valve cleaning.

CAUTION

Abrupt movement of internal spools can cause stored fluid to be released suddenly.

6. Clean cartridge valve by submerging valve in clean mineral spirits to flush out contamination. Particles as fine as talcum powder can affect the operation of high pressure hydraulic valves. If cartridge design allows, use a wood or plastic probe to push the internal spool in and out 20 to 30 times to flush out contamination. Be extremely careful to not damage cartridge. Use compressed air for cleaning.

7. Install the cartridge valve into control manifold:

A. Lubricate new seal kit components with clean hydraulic oil and install on valve. The O−rings, sealing rings and backup rings must be arranged properly on the cartridge valve for proper operation and sealing.

IMPORTANT: Use care when handling the valve cartridge. Slight bending or distortion of the stem tube can cause binding and malfunction.

B. Thread cartridge valve carefully into correct manifold port. The valve should go in easily without binding.

C. Torque cartridge valve using a deep socket to values identified in Figure 19.

8. If solenoid cartridge was removed, carefully install solenoid coil onto the cartridge valve. Install nut and torque nut to **60 in−lb (6.8 N−m)** (do not over tighten).

9. After assembly, if problems still exist, remove valve and clean again or replace valve.

Lift Cylinder

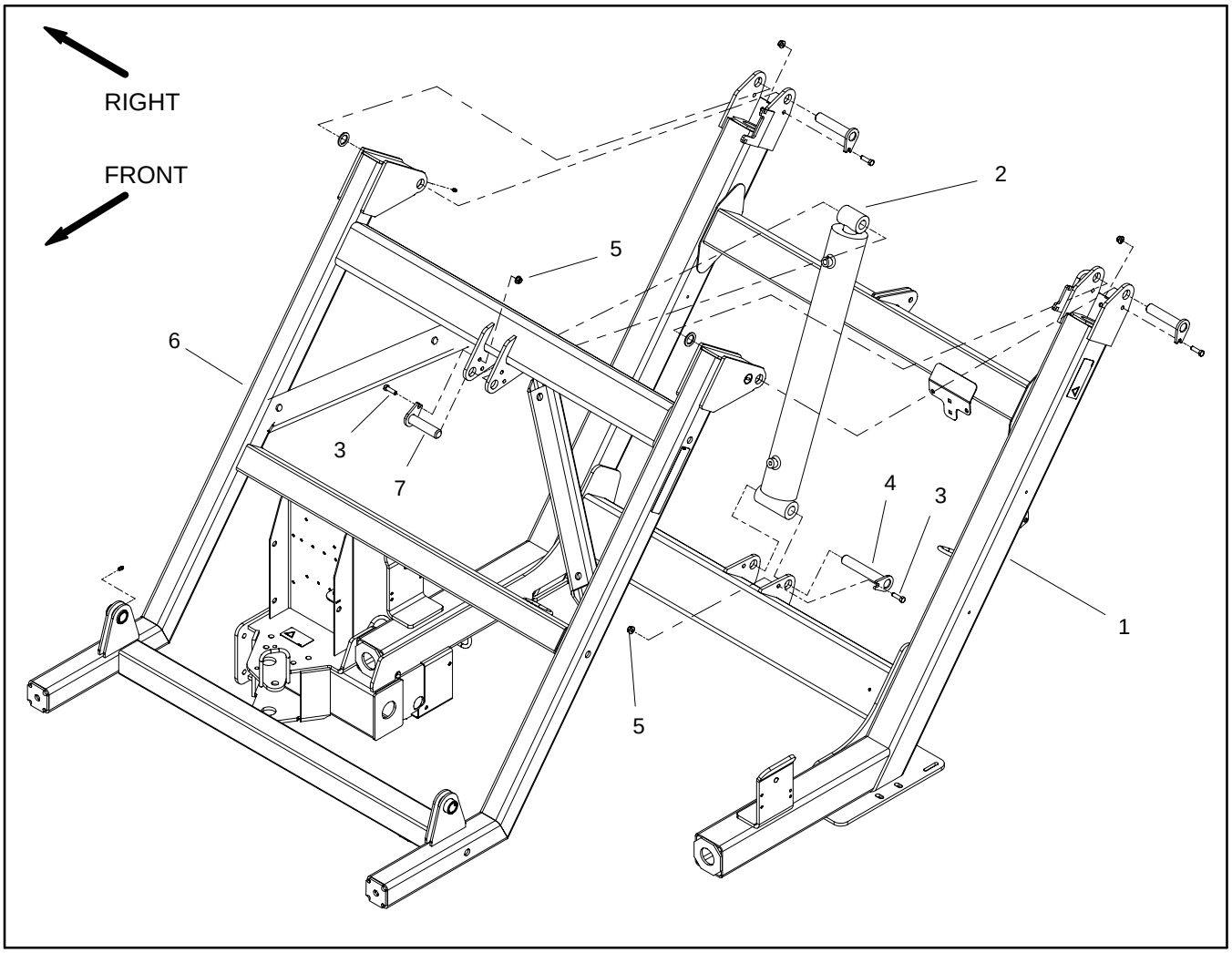

Figure 20

1. **Main sweeper frame**
2. **Lift cylinder**
3. **Cap screw**
4. **Pivot pin**
5. **Lock nut**
6. **Pitch frame**
7. **Pivot pin**

Removal (Fig. 20)

1. Position sweeper on a level surface with dump hopper empty and fully lowered. Chock sweeper wheels to prevent sweeper from moving. If sweeper is attached to tow vehicle, apply tow vehicle parking brake, stop engine and remove key from the ignition switch.

CAUTION

Before disconnecting any hydraulic components, operate all sweeper hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil. See Relieving Hydraulic System Pressure in the General Information section of this chapter.

2. Relieve sweeper hydraulic system pressure.

WARNING

Make sure that sweeper is fully lowered before loosening hydraulic hose from lift cylinder. If sweeper is not fully lowered as hose is loosened, sweeper may drop unexpectedly.

3. Disconnect hydraulic hose from hydraulic fitting on lift cylinder (Fig. 21). Locate and discard O−ring from between hose and fitting. Allow hose to drain into a suitable container.

4. Plug disconnected hose and lift cylinder fitting to prevent contamination.

5. Remove lock nuts (item 5) and cap screws (item 3) that are used to retain lift cylinder pivot pins (items 4 and 7) to sweeper frame.

CAUTION

To prevent personal injury, make sure that lift cylinder is supported as it is removed from the machine. Lift cylinder weighs approximately 43 pounds (19.5 kg).

6. Support lift cylinder and slide pivot pins from the lift cylinder and machine frame.

7. Remove lift cylinder from the machine.

8. If needed, remove hydraulic check valve fitting and O−ring from the lift cylinder (Fig. 21). Discard O−ring.

Installation (Fig. 20)

1. If removed, install hydraulic check valve fitting and new O−ring into lift cylinder (Fig. 21) (see Hydraulic Fitting Installation in the General Information section of this chapter).

2. Position lift cylinder to the machine mounting points. Make sure the port of the lift cylinder faces the front of the machine.

3. Align lift cylinder mounting holes with frame mounts. Install pivot pins. Secure pivot pins to frame with cap screws and lock nuts.

4. Remove plugs from disconnected hose and fitting.

5. Connect hydraulic hose with new O−ring to hydraulic fitting on lift cylinder. Tighten hose connection (see Hydraulic Hose and Tube Installation in the General Information section of this chapter).

6. Lubricate grease fittings on lift cylinder.

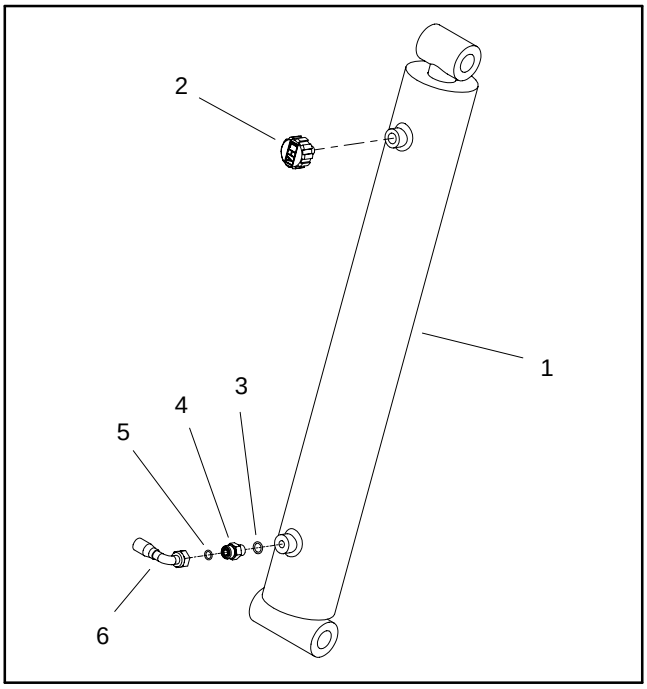

Figure 21

1. **Lift cylinder**
2. **Breather**
3. **O−ring**
4. **Check valve fitting**
5. **O−ring**
6. **Hydraulic hose**

Lift Cylinder Service

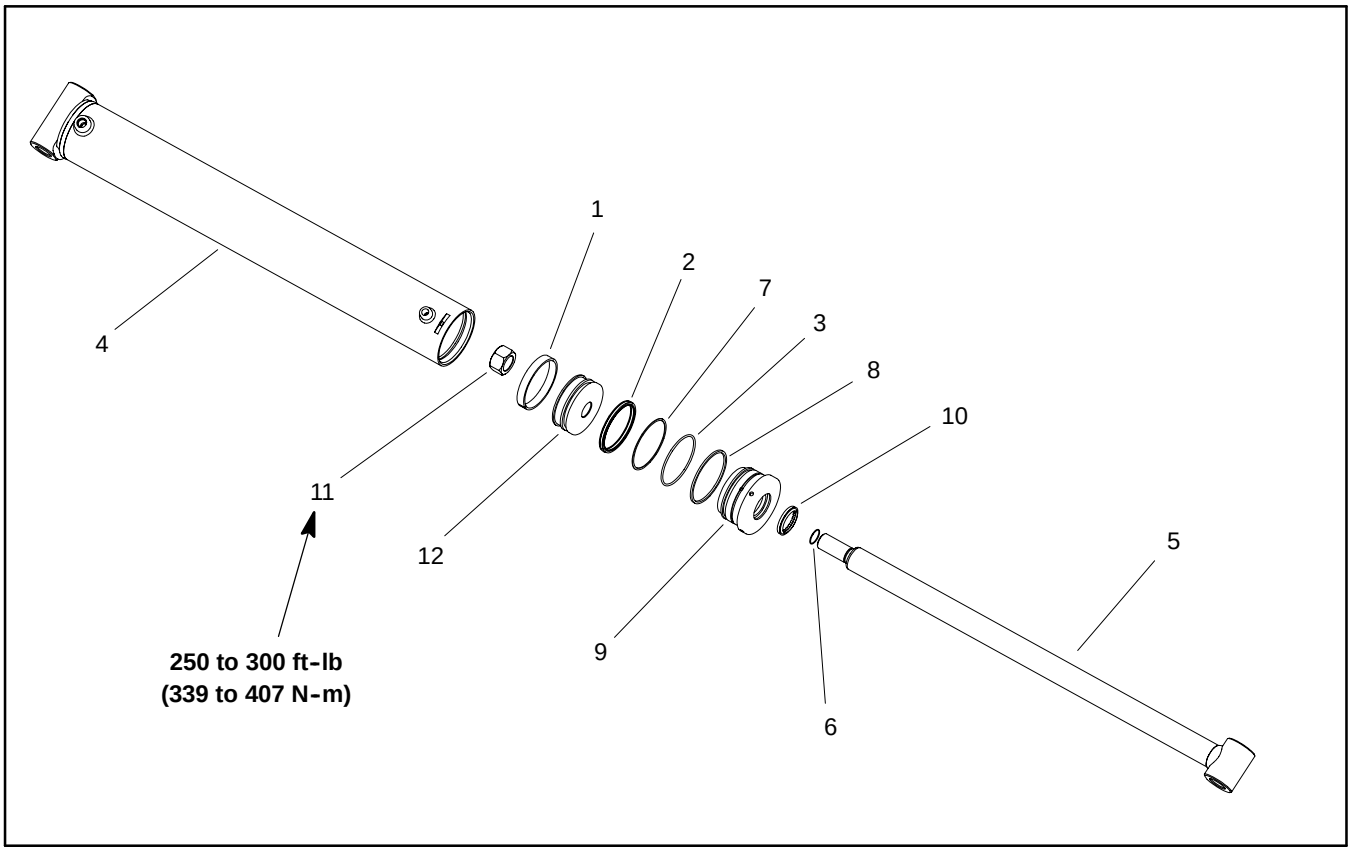

Figure 22

1. **Wear ring**
2. **Seal**
3. **O-ring**
4. **Tube**
5. **Rod**
6. **O-ring**
7. **Backup ring**
8. **Retaining ring**
9. **Head**
10. **Wiper**
11. **Lock nut**
12. **Piston**

Disassembly (Fig. 22)

1. Remove oil from the lift cylinder into a drain pan by **slowly** pumping the cylinder rod. Plug ports and clean the outside of the lift cylinder.

IMPORTANT: Prevent damage when clamping the lift cylinder into a vise; clamp on the clevis only.

2. Mount lift cylinder in a vise so that the shaft end tilts up slightly.

3. Using a spanner wrench, rotate head (item 9) clockwise until the edge of the retaining ring appears in the tube opening. Insert a screwdriver under the beveled edge of the retaining ring to start the retaining ring through the tube opening. Rotate the head counter-clockwise to remove retaining ring (item 8) as shown in Figure 23.

4. Grasp end of rod; extract rod assembly by carefully twisting and pulling on the rod.

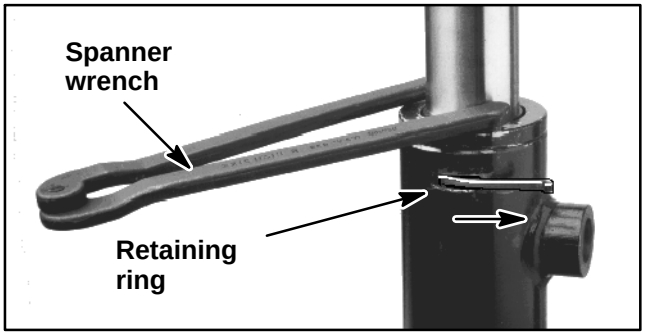

Figure 23

IMPORTANT: Do not clamp vise jaws against rod surface.

5. Mount rod securely in a vise by clamping vise on the clevis of the shaft. Remove lock nut (item 11) and carefully slide piston and head from the rod.

IMPORTANT: When removing seal components, be careful to not scratch or damage piston or head.

6. Remove and discard seal kit components from the head and piston.

Inspection

CAUTION

Use eye protection such as goggles when using compressed air

1. Wash all cylinder parts in solvent. Dry parts with compressed air.

2. Inspect internal surface of tube for deep scratches, out–of–roundness and bending.

3. Inspect rod, piston and head for excessive pitting, scoring or wear.

4. If cylinder components are found to be worn or damaged, replace cylinder.

Assembly (Fig. 22)

1. Coat new seal kit components with clean hydraulic oil.

IMPORTANT: When installing seal components, be careful to not scratch or damage piston or head.

2. Install new seals to the head and piston.

IMPORTANT: Do not clamp vise jaws against rod surface.

3. Mount rod securely in a vise by clamping vise on the clevis of the shaft. Carefully slide head assembly and piston assembly onto the rod.

4. Thread lock nut (item 11) onto rod. Torque lock nut from **250 to 300 ft–lb (339 to 407 N–m)**.

5. Remove rod assembly from vise.

IMPORTANT: Prevent damage when clamping the tube into a vise; clamp on the clevis only.

6. Mount tube in a vise so that the rod end tilts up slightly.

IMPORTANT: When installing the head into the tube, pay careful attention to the retaining ring slot in the tube to ensure that the backup ring does not lodge in the slot.

7. Coat all internal lift cylinder parts with a light coating of clean hydraulic oil. Slide rod assembly into tube being careful to not damage the seals.

8. Secure head in tube by installing retaining ring (item 8).

A. Align retaining ring hole in the head with the access slot in the tube.

B. Insert the retaining ring hook into the hole and rotate head clockwise until the retaining ring is completely pulled into the tube and the ends are covered.

C. Apply silicone sealer to tube access slot.

Offset Cylinder

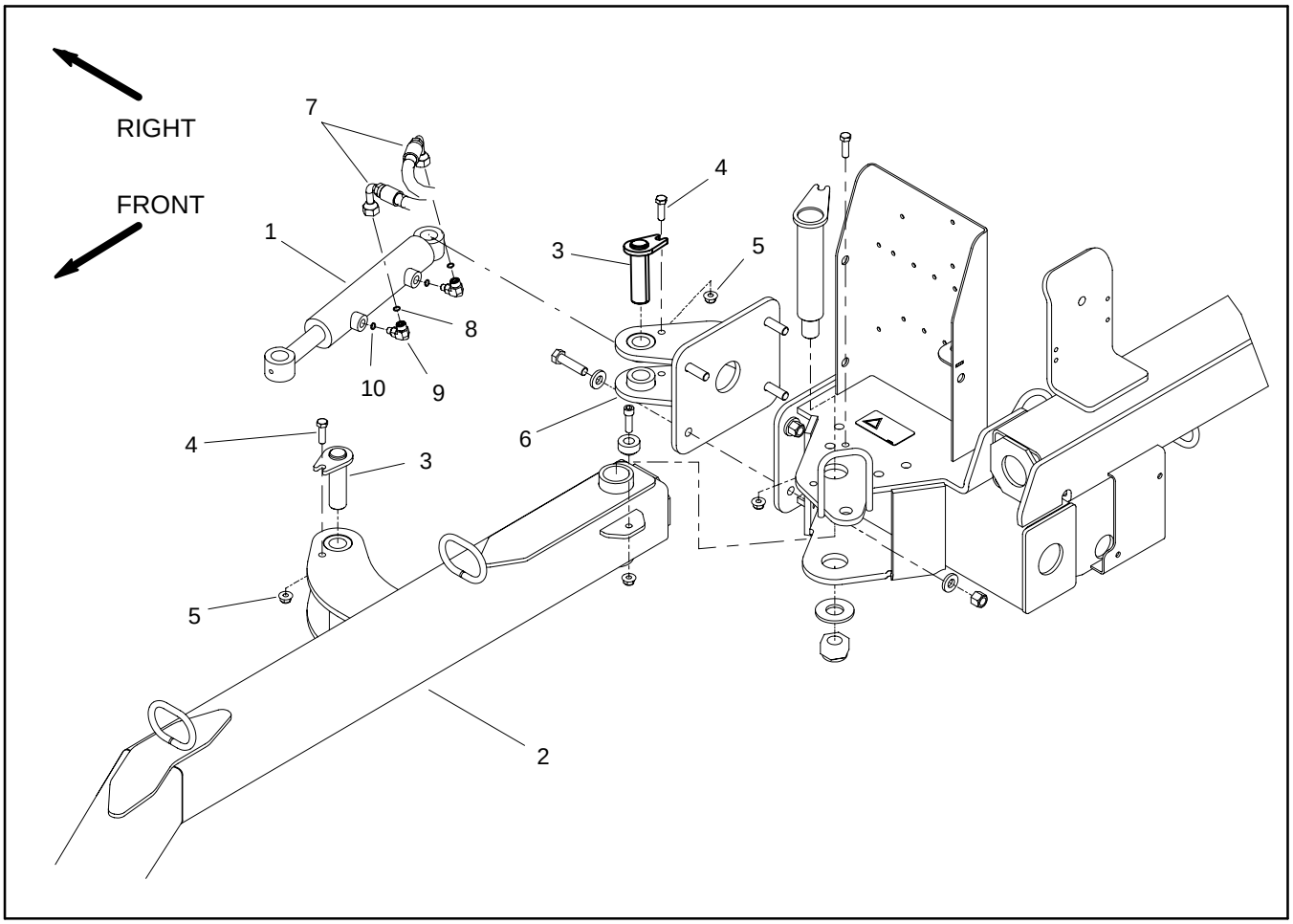

Figure 24

1. **Offset cylinder**
2. **Hitch tongue**
3. **Pivot pin (2 used)**
4. **Cap screw (2 used)**
5. **Flange nut (2 used)**
6. **Bracket**
7. **Hydraulic hose (2 used)**
8. **O-ring**
9. **90º hydraulic fitting (2 used)**
10. **O-ring**

Removal (Fig. 24)

1. Position sweeper on a level surface with dump hopper empty and fully lowered. Chock sweeper wheels to prevent sweeper from moving. If sweeper is attached to tow vehicle, apply tow vehicle parking brake, stop engine and remove key from the ignition switch.

CAUTION

Before disconnecting any hydraulic components, operate all sweeper hydraulic controls to relieve system pressure and avoid injury from pressurized hydraulic oil. See Relieving Hydraulic System Pressure in the General Information section of this chapter.

2. Relieve sweeper hydraulic system pressure.

3. To prevent contamination of hydraulic system during offset cylinder removal, thoroughly clean exterior of cylinder and fittings.

NOTE: To ease installation, label the hydraulic hoses to show their correct position on the offset cylinder.

4. Remove hydraulic hoses from offset cylinder. Locate and discard O−rings from between hoses and fittings. Allow hoses to drain into a suitable container.

5. Plug disconnected hoses and offset cylinder fittings to prevent contamination.

6. Remove flange nuts (item 5) and cap screws (item 4) that are used to retain offset cylinder pivot pins (item 3) to sweeper frame.

7. Support offset cylinder and slide pivot pins from the cylinder and machine frame.

8. Remove offset cylinder from the machine.

9. If hydraulic fittings are to be removed from offset cylinder, mark fitting orientation to allow correct assembly. Remove fittings from cylinder and discard O−rings.

Installation (Fig. 24)

1. If fittings were removed from offset cylinder, lubricate and place new O−rings onto fittings. Install fittings into port openings using marks made during the removal process to properly orientate fittings. Tighten fittings (see Hydraulic Fitting Installation in the General Information section of this chapter).

2. Position offset cylinder to the machine mounting points. Make sure the ports of the offset cylinder face the hitch tongue.

3. Align offset cylinder mounting holes with frame mounts. Install pivot pins and secure with cap screws and flange nuts.

4. Remove plugs from disconnected hoses and cylinder fittings.

5. Connect hydraulic hoses with new O−rings to hydraulic fittings on offset cylinder. Tighten hose connections (see Hydraulic Hose and Tube Installation in the General Information section of this chapter).

6. Lubricate grease fittings on offset cylinder.

Offset Cylinder Service

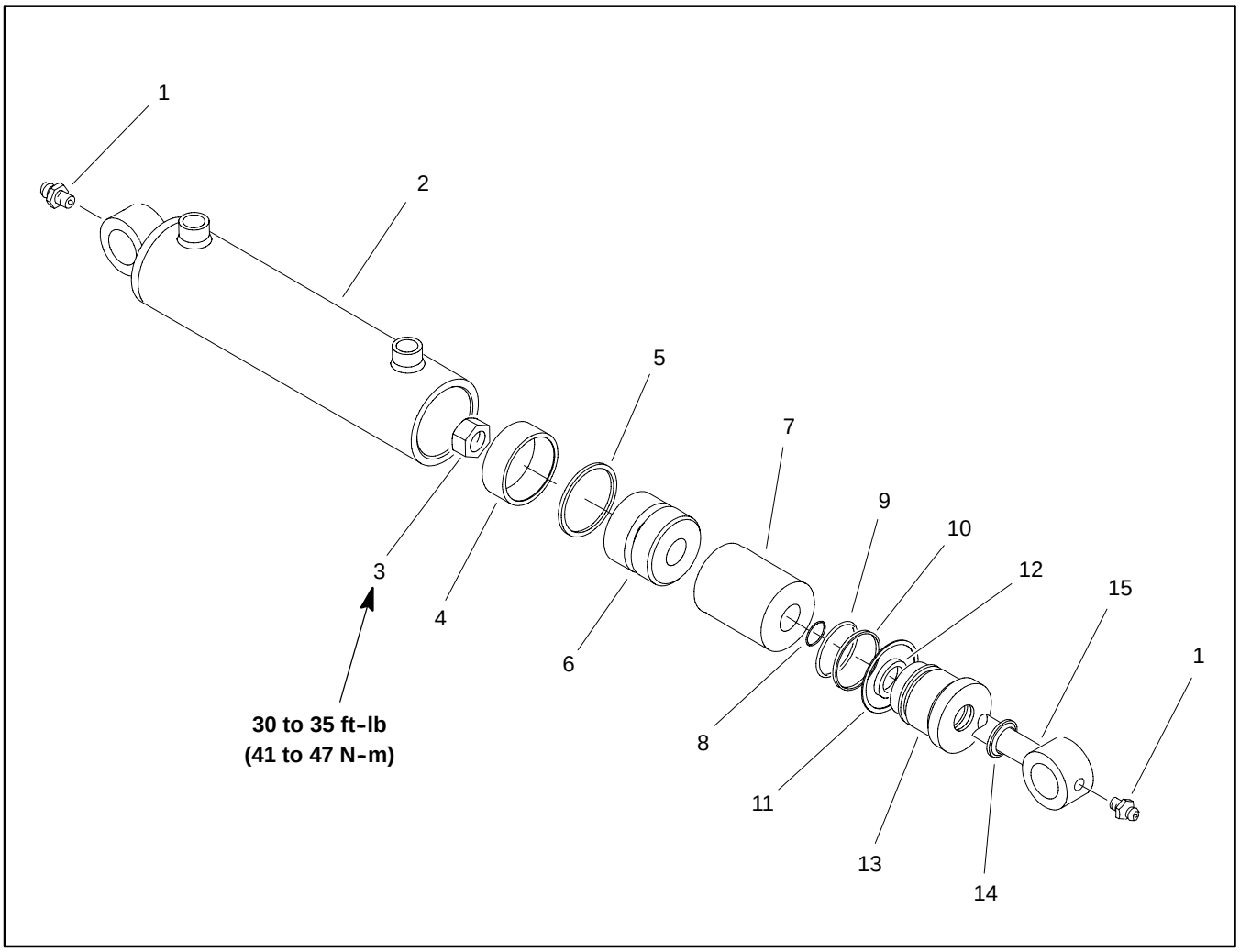

Figure 25

1. **Grease fitting**
2. **Tube**
3. **Lock nut**
4. **Wear ring**
5. **Capseal**
6. **Piston**
7. **Spacer**
8. **O-ring**
9. **O-ring**
10. **Backup washer**
11. **Retaining ring**
12. **Seal**
13. **Head**
14. **Wiper**
15. **Rod**

Disassembly (Fig. 25)

1. Remove oil from offset cylinder into a drain pan by slowly pumping the cylinder rod. Plug both ports and clean the outside of the cylinder.

IMPORTANT: Prevent damage when clamping the cylinder in a vise; clamp on the clevis only.

2. Mount offset cylinder securely in a vise by clamping on the clevis end of the tube. Use of a vise with soft jaws is recommended.

3. Loosen head from tube:

   A. Use a spanner wrench to rotate head clockwise until the edge of the retaining ring appears in the tube opening.

   B. Insert a screwdriver under the beveled edge of the retaining ring to start the retaining ring through the tube opening.

   C. Rotate the head counter-clockwise to remove retaining ring from tube and head.

4. Extract rod with head and piston by carefully twisting and pulling on the shaft.

IMPORTANT: Do not clamp vise jaws against the rod surface.

5. Mount rod assembly securely in a vise by clamping on the clevis of the rod. Remove lock nut and piston from the rod. Slide head off the rod.

IMPORTANT: When removing seal components, be careful to not scratch or damage piston or head.

6. Remove and discard all seal kit components from the piston and the head.

CAUTION

Use eye protection such as goggles when using compressed air

7. Wash all cylinder parts in clean solvent. Dry parts with compressed air. Do not wipe parts dry with paper towels or cloth. Lint in a hydraulic system will cause damage.

8. Carefully inspect internal surface of tube for damage (deep scratches, out-of-round, etc.). Inspect rod and piston for evidence of excessive scoring, pitting or wear. Replace offset cylinder if internal components are found to be worn or damaged.

Assembly (Fig. 25)

1. Make sure all cylinder components are thoroughly cleaned before assembly.

2. Coat new seal kit components with clean hydraulic oil.

IMPORTANT: When installing seal components to piston and head, be careful to not scratch or damage piston or head.

   A. Install new seals and O-rings to the piston.

   B. Install new seals, O-ring and back-up ring to the head.

IMPORTANT: Do not clamp vise jaws against the rod surface.

3. Mount rod securely in a vise by clamping on the clevis of the rod.

   A. Coat shaft with clean hydraulic oil.

   B. Carefully slide head and piston onto the rod. Secure piston to shaft with lock nut.

   C. Torque lock nut from **30 to 35 ft-lb (41 to 47 N-m)**.

IMPORTANT: When installing the head into the tube, pay careful attention to the retaining ring slot in the tube to ensure that the backup ring does not lodge in the slot.

4. Lubricate head and piston with clean hydraulic oil. Carefully slide shaft assembly into cylinder tube.

IMPORTANT: Prevent damage when clamping the cylinder's tube in a vise; clamp on the clevis only.

5. Mount offset cylinder in a vise with soft jaws. Secure head in tube:

   A. Align retaining ring hole in the head with the access slot in the tube.

   B. Insert the retaining ring hook into the hole and rotate head clockwise until the retaining ring is completely pulled into the tube and the ring ends are covered.

   C. Apply silicone sealer to tube access slot.

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Chapter 4

Electrical System

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General Information

Operator's Manual

The Operator's Manual provides information regarding the operation, general maintenance and maintenance intervals for your Pro Sweep machine. Refer to that publication for additional information when servicing the machine.

Electrical Diagrams

The electrical schematic, circuit drawings and wire harness drawings for the Pro Sweep are located in Chapter 6 – Electrical Diagrams.

Special Tools

Multimeter

The multimeter can test electrical components and circuits for current (amps), resistance (ohms) or voltage. Obtain this tool locally.

NOTE: Toro recommends the use of a DIGITAL Volt–Ohm–Amp multimeter when testing electrical circuits. The high impedance (internal resistance) of a digital meter in the voltage mode will make sure that excess current is not allowed through the meter. This excess current can cause damage to circuits not designed to carry it.

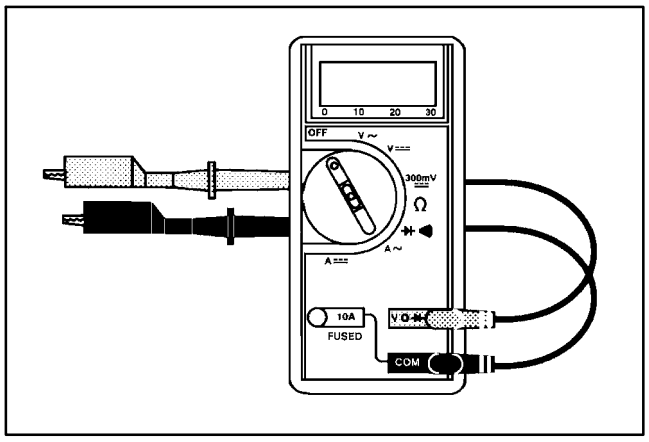

Figure 1

Troubleshooting

CAUTION

Remove all jewelry, especially rings and watches, before doing any electrical trouble-shooting or testing. Disconnect the sweeper power harness from the vehicle unless the test requires battery voltage.

For effective troubleshooting and repairs, there must be a good understanding of the electrical circuits (see Chapter 6 – Electrical Diagrams) and components used on this machine.

If the machine has any interlock switches by–passed, they must be reconnected for proper safety and trouble-shooting.

Problem	Possible Causes
No sweeper functions operate.	Electrical power from tow vehicle is not available (e.g. sweeper power harness not connected to tow vehicle, tow vehicle key not ON, vehicle battery is discharged). Sweeper fuse (20 Amp) is faulty. Control module has timed out due to 30 minutes of inactivity. Wires for remote transmitter learn function are plugged together. Remote transmitter batteries are discharged. Remote transmitter and control module are not synchronized. Hydraulic problem exists (see Chapter 3 – Hydraulic System). Remote transmitter is faulty. Control module is faulty.
Brush does not rotate.	Sweeper is raised (brush should only rotate when sweeper is below the transport position). Broom enable proximity switch is out of adjustment. Broom enable proximity switch or circuit wiring is faulty. Broom relay or circuit wiring is faulty. Solenoid valve coil (SRV) or circuit wiring is faulty. Hydraulic problem exists (see Chapter 3 – Hydraulic System).
Brush rotates (but should not) when sweeper is raised above the turn around position.	Broom enable proximity switch is out of adjustment. Broom enable proximity switch or circuit wiring is faulty. Broom relay or circuit wiring is faulty.

Problem	Possible Causes
Sweeper does not raise at all.	Control module has timed out due to 30 minutes of inactivity. Turn around position proximity switch is out of adjustment (sweeper not directly behind tow vehicle). Transport position proximity switch is out of adjustment (sweeper directly behind tow vehicle). Diode D3 is faulty. Up Function Select relay or circuit wiring is faulty. Turn around position proximity switch or circuit wiring is faulty (sweeper not directly behind tow vehicle). Transport position proximity switch or circuit wiring is faulty (sweeper directly behind tow vehicle). Solenoid valve coil (SV3) or circuit wiring is faulty. Hydraulic problem exists (see Chapter 3 – Hydraulic System). Remote transmitter is faulty (other functions affected as well). Control module is faulty (other functions affected as well).
Sweeper will raise to the turn around position but does not raise to the transport or dump position.	Sweeper is offset (not directly behind tow vehicle). Hitch home proximity switch is out of adjustment. Transport position proximity switch is out of adjustment. Hitch home proximity switch or circuit wiring is faulty. Transport position proximity switch or circuit wiring is faulty. Hopper Height Select relay or circuit wiring is faulty.
Sweeper will raise to the turn around and transport positions but does not raise to dump position.	Sweeper not in transport height position when transmitter dump sequence is entered. Transmitter button dump sequence not entered correctly. Hitch Home Verify for Dump relay or circuit wiring is faulty.

Problem	Possible Causes
Sweeper does not lower.	Control module has timed out due to 30 minutes of inactivity. Hopper safety support is installed on lift cylinder. Diode D1 is faulty. Down Float Latch relay or circuit wiring is faulty. Down Latch Release relay or circuit wiring is faulty. Solenoid valve coil (SV2) or circuit wiring is faulty. Hydraulic problem exists (see Chapter 3 – Hydraulic System).
Sweeper offset does not function.	Control module has timed out due to 30 minutes of inactivity. Offset lockout proximity switch is out of adjustment. Offset Lockout relay or circuit wiring is faulty. Offset lockout proximity switch or circuit wiring is faulty. Solenoid valve coil(s) (SV1) or circuit wiring is faulty. Hydraulic problem exists (see Chapter 3 – Hydraulic System).

Safety Interlock System

CAUTION

Do not disconnect the Pro Sweep proximity switches or dump beeper. They are for the operator's protection. Check operation of the switches and beeper daily to make sure the interlock system is operating correctly. If any switch or the beeper is not operating properly, adjust or replace it before operating the sweeper.

The Pro Sweep safety interlock system ensures the following:

1. The brush will not rotate when the dump hopper is in the raised position.

2. The dump hopper cannot be emptied when the sweeper is in the offset position (not directly behind the tow vehicle).

3. The dump beeper will sound when emptying the hopper.

Interlock system operation is described in the Pro Sweep Operator's Manual. Testing procedures for the interlock system proximity switches and dump beeper are included in the Component Testing section of this Chapter.

Proximity Switches

The Pro Sweep uses five (5) identical inductive proximity switches to control sweeper operation. These proximity switches are normally open and close when a sweeper frame component is positioned near the target end of the switch. The switches incorporate a LED on the cable end of the switch. The LED illuminates when the switch is in the closed position. The switches are mounted on the main sweeper frame in three (3) locations. Refer to Proximity Switches in the Component Testing section for additional switch information.

Proximity Switch Adjustment

1. Position sweeper on a level surface with dump hopper empty and lowered. Have sweeper attached to towing vehicle with the sweeper positioned directly behind the tow vehicle (not offset). Engage vehicle parking brake, stop engine and remove key from the ignition switch. Chock sweeper wheels to prevent sweeper from moving.

2. The target surface end of proximity switch should be from 0.110” to 0.170” (2.8 to 4.3 mm) from sensing plate on sweeper (Figs. 2 and 3).

3. If necessary, loosen jam nuts on switch and adjust switch location to allow proper clearance between switch and sensing plate.

4. After adjustment, torque jam nuts from **165 to 195 in-lb (18.7 to 22.0 N-m)**. After tightening jam nuts, check that clearance between end of proximity switch and sensing plate has not changed.

5. After adjustment is complete, make sure that proximity switch connector is plugged into sweeper wire harness.

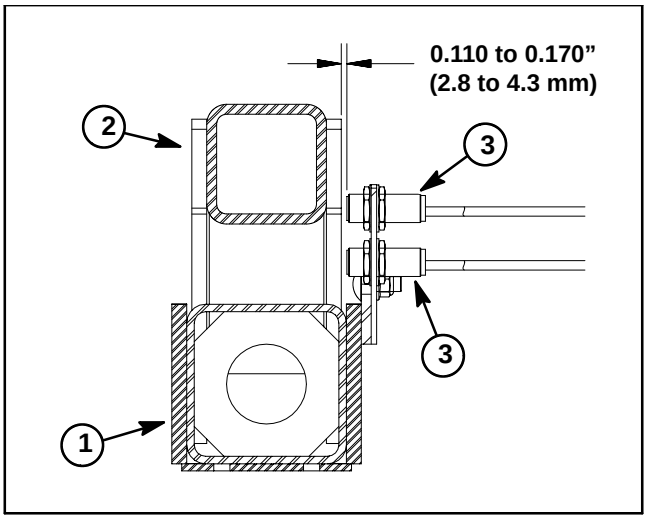

Figure 2

1. **Main frame**
2. **Pitch frame**
3. **Proximity switch**

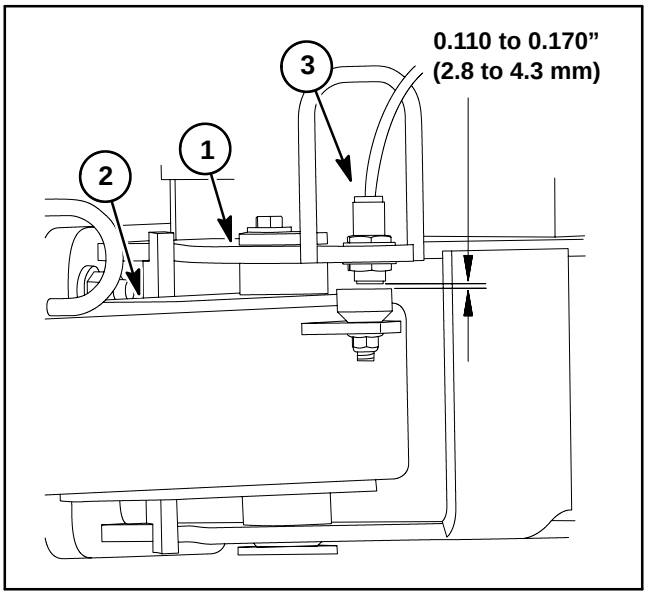

Figure 3

1. **Main frame**
2. **Tongue hitch**
3. **Proximity switch**

Component Testing

For accurate resistance and/or continuity checks, electrically disconnect the component being tested from the circuit (e.g. unplug the relay wire harness connector before doing a continuity check on relay).

CAUTION

When testing electrical components for continuity with a multimeter (ohms setting), make sure that power to the circuit has been disconnected.

Fuse

The Pro Sweep uses a single 20 amp fuse for circuit protection. The fuse holder is located in the wire harness (Fig. 4). If the fuse is faulty or missing, no electrical power will be available for sweeper operation.

Testing

Remove fuse from the fuse holder for testing. Fuse should have continuity between fuse terminals.

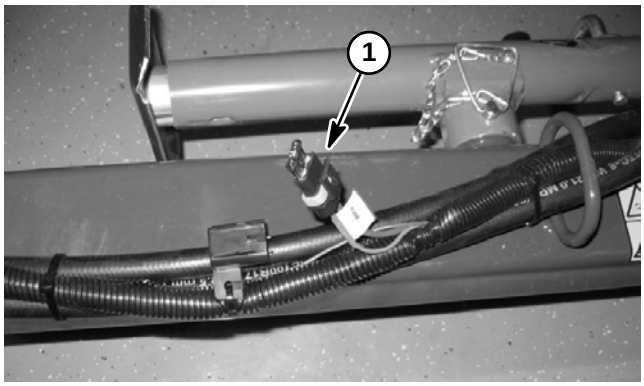

Figure 4

1. **Fuse holder**

Diode Assemblies

Three (3) diode assemblies are used in the Pro Sweep to provide logic for the control module functions. Diode D1 provides logic control for the sweeper down function. Diodes D2 and D3 provide logic control for the sweeper up function. All of these diodes plug into the wire harness and are located near the offset cylinder.

Diode Testing

The diode (Fig. 5) can be tested using a digital multimeter (diode test setting) and the table to the right.

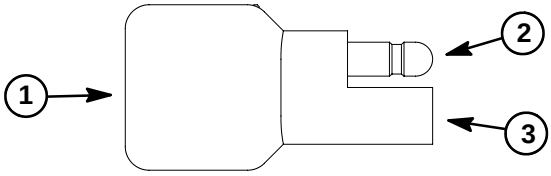

Figure 5

1. **Diode**
2. **Male terminal**
3. **Female terminal**

Multimeter Red Lead (+) on Terminal	Multimeter Black Lead (-) on Terminal	Continuity
Female	Male	YES
Male	Female	NO

Dump Beeper

The dump beeper sounds to notify the operator and bystanders when the sweeper is raised for the hopper dump function. The beeper is attached to the frame in front of the RH wheel (Fig. 6).

Testing

1. Position sweeper on a level surface with dump hopper lowered. If sweeper is attached to towing vehicle, apply vehicle parking brake, stop engine and remove key from the ignition switch.

2. To ensure that electrical power is removed from Pro Sweep, disconnect sweeper power harness from tow vehicle.

3. Remove cover from frame to access dump beeper.

4. Disconnect wire harness connector from beeper.

IMPORTANT: Make sure to observe polarity on the beeper terminals when testing. Damage to the beeper may result from an improper connection.

5. Correctly connect 12VDC source to the beeper terminals (Fig. 7).

6. Beeper should sound as long as 12VDC is connected to the beeper terminals.

7. Disconnect voltage source from the beeper. Reconnect wire harness connector to beeper.

8. Secure cover to frame. Connect sweeper power harness to tow vehicle.

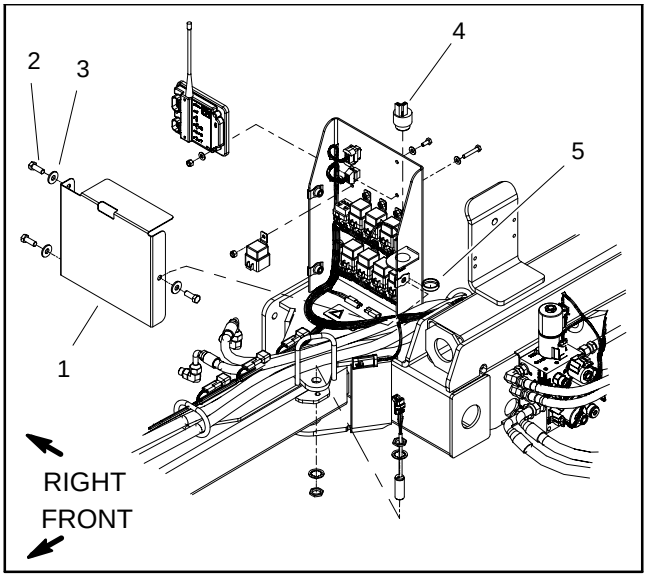

Figure 6

1. **Cover**
2. **Cap screw (3 used)**
3. **Washer (3 used)**
4. **Dump beeper**
5. **Tinnerman nut (3 used)**

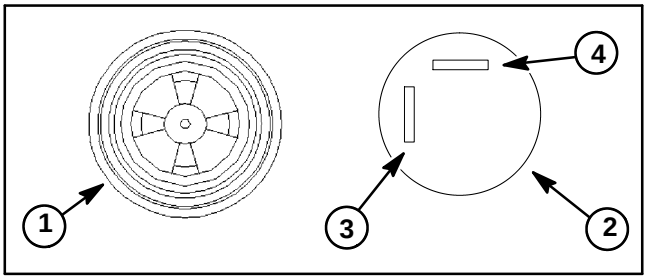

Figure 7

1. **Top view**
2. **Bottom view**
3. **Positive (+) terminal**
4. **Negative (-) terminal**

Relays

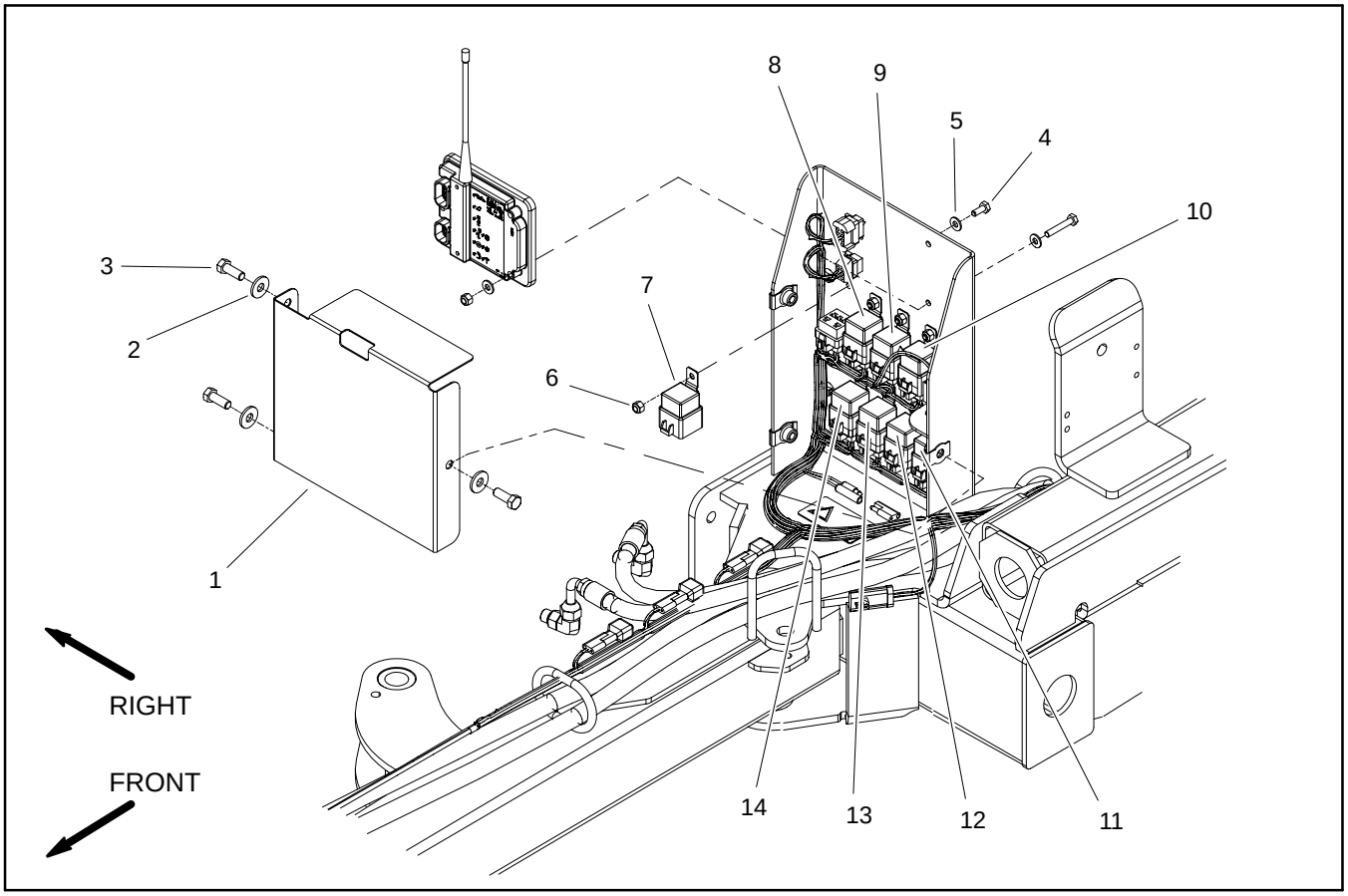

Figure 8

1. **Cover**
2. **Flat washer (3 used)**
3. **Cap screw (3 used)**
4. **Cap screw (8 used)**
5. **Flat washer (8 used)**
6. **Lock nut (8 used)**
7. **Hopper Height Select relay**
8. **Logic Inverter relay**
9. **Broom relay**
10. **Up Function Select relay**
11. **Offset Lockout relay**
12. **Down Latch Release relay**
13. **Down Float Latch relay**
14. **Hitch Home Verify for Dump relay**

The electrical system of the Pro Sweep includes eight (8) relays used to control sweeper operation. These relays are identical and are attached to the frame in front of the RH wheel (Fig. 8). Relays can be identified by a tag on the wire harness. Refer to circuit drawings in Chapter 6 – Electrical Diagrams for additional relay information.

Relay Operation

The Broom relay is used to control the energizing of hydraulic manifold solenoid (SRV). When the Broom relay is not energized (broom enable proximity switch open), solenoid (SRV) will not be energized and the broom will be stationary (not rotating). When the Broom relay is energized (broom enable proximity switch closed), solenoid (SRV) will be energized to allow hydraulic flow to the broom motor so the broom will rotate.

The Down Latch Release and Down Float Latch relays are used to control the sweeper down function. These relays ensure that the sweeper continues to lower when the operator presses the remote transmitter sweeper down button. The relays are also used to stop the lowering of the sweeper when the operator presses either the stop or up button on the remote transmitter.

The Logic Inverter relay is used to stop the sweeper down function. During normal sweeper operation, the Logic Inverter relay is energized by the remote receiver which allows the operator to initiate the sweeper down function with the remote transmitter. When the operator presses the remote transmitter stop button, the Logic Inverter relay is de–energized which causes the sweeper down function to stop.

The Up Function Select relay is used to control the energizing of hydraulic manifold solenoid (SV3) to raise the sweeper. When the Up Function Select relay is not energized, solenoid (SV3) can be energized by the operator for the hopper dump function. When the Up Function Select relay is energized, solenoid (SV3) can be energized by the operator for the sweeper up function.

The Hopper Height Select relay is used control the height that the hopper can be raised. When the Hopper Height Select relay is not energized (sweeper is offset so hitch home proximity switch is open), the hopper can only be raised to the turn–around position. When the Hopper Height Select relay is energized (hitch home proximity switch is closed), the hopper can be raised to the transport position and the hopper dump function is allowed.

The Hitch Home Verify for Dump relay is used to prevent the hopper dump function when the sweeper is offset (not directly behind the tow vehicle). When the Hitch Home Verify for Dump relay is not energized (sweeper is offset so hitch home proximity switch is open), the hopper dump function is disabled. When the Hitch Home Verify for Dump relay is energized (hitch home proximity switch is closed), the hopper dump function is allowed.

The Offset Lockout relay is used to prevent offsetting the sweeper when the dump hopper is raised. When the Offset Lockout relay is not energized (hopper raised so offset lockout proximity switch is open), sweeper offset (both right and left) is disabled. The energized Offset Lockout relay also causes the dump beeper to sound. When the Offset Lockout relay is energized (hopper lowered so offset lockout proximity switch is closed), sweeper offset is allowed.

Relay Testing

1. Position sweeper on a level surface with dump hopper lowered. If sweeper is attached to towing vehicle, apply vehicle parking brake, stop engine and remove key from the ignition switch. To ensure that electrical power is removed from Pro Sweep, disconnect sweeper power harness from tow vehicle.

2. Remove cover from frame to access relays (Fig. 8).

3. Locate relay that is to be tested. Disconnect wire harness connector from relay. Remove relay from mounting bracket for testing.

NOTE: Prior to taking small resistance readings with a digital multimeter, short the meter test leads together. The meter will display a small resistance value (usually 0.5 ohms or less). This resistance is due to the internal resistance of the meter and test leads. Subtract this value from from the measured value of the component you are testing.

4. Verify coil resistance between terminals 85 and 86 with a multimeter (ohms setting). Resistance should be from 70 to 90 ohms.

5. Connect multimeter (ohms setting) leads to relay terminals 30 and 87. Ground terminal 86 and apply +12 VDC to terminal 85. The relay should make and break continuity between terminals 30 and 87 as +12 VDC is applied and removed from terminal 85.

6. Disconnect voltage from terminal 85 and multimeter lead from terminal 87.

7. Connect multimeter (ohms setting) leads to relay terminals 30 and 87A. Apply +12 VDC to terminal 85. The relay should break and make continuity between terminals 30 and 87A as +12 VDC is applied and removed from terminal 85.

8. Disconnect voltage and multimeter leads from the relay terminals.

9. Secure relay to mounting bracket and connect wire harness connector to relay.

10. Secure cover to frame. Connect sweeper power harness to tow vehicle.

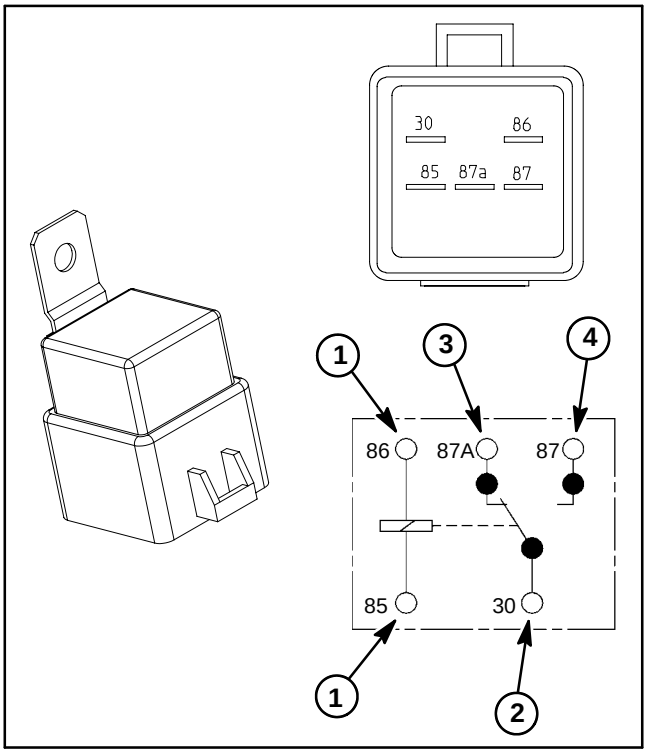

Figure 9

1. **Coil terminal**
2. **Common terminal**
3. **Normally closed term.**
4. **Normally open term.**

Proximity Switches

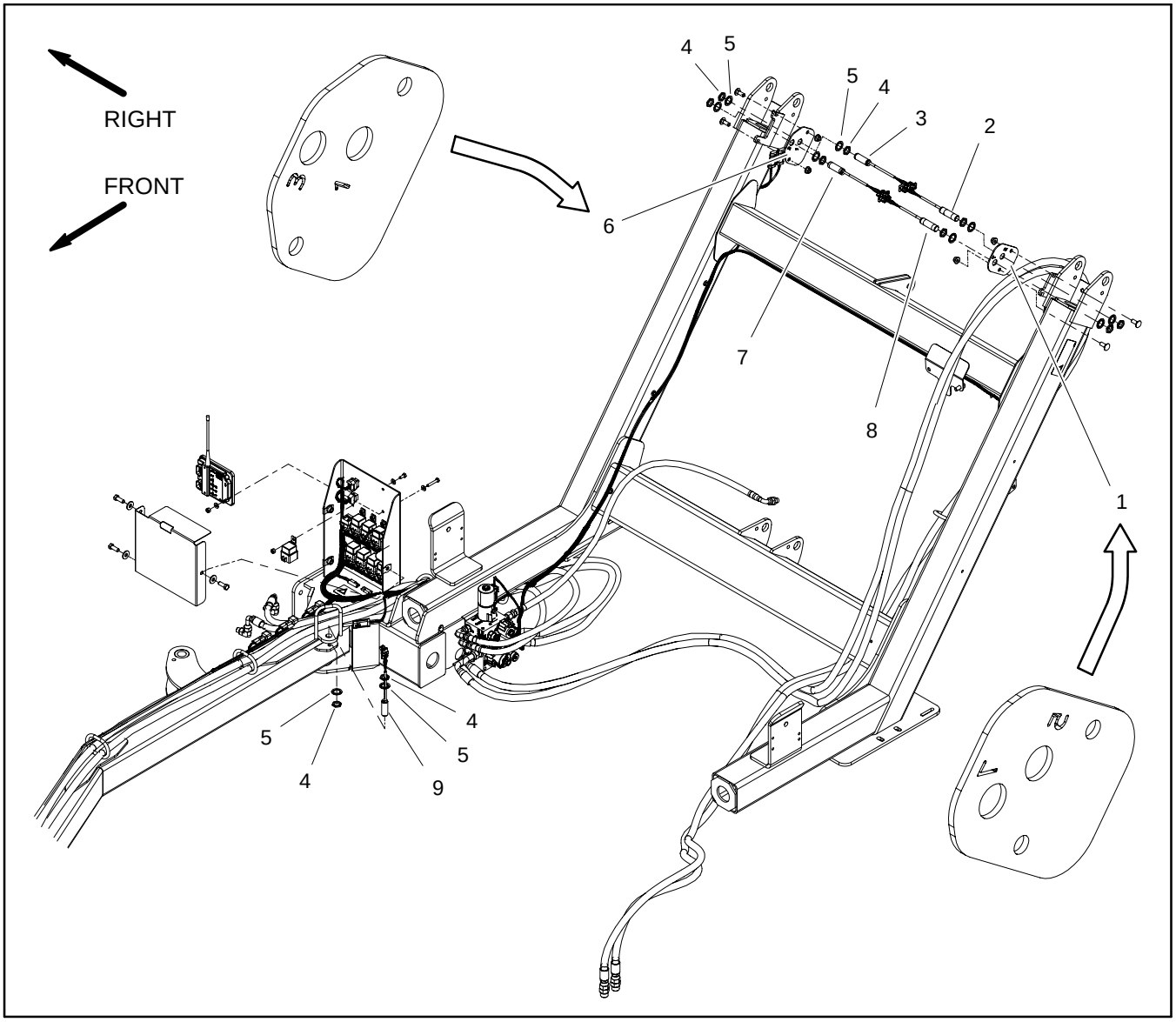

Figure 10

1. **LH switch plate**
2. **Offset lockout switch (hole 5)**
3. **Turn around position switch (hole 1)**
4. **Lock nut (2 used per switch)**
5. **Lock washer (2 used per switch)**
6. **RH switch plate**
7. **Transport position switch (hole 3)**
8. **Broom enable switch (hole 7)**
9. **Hitch home switch**

The Pro Sweep uses five (5) identical inductive proximity switches to control sweeper operation. These proximity switches are normally open and close when a sweeper frame component is positioned near the target end of the switch. The switches incorporate a LED on the cable end of the switch. The LED illuminates when the switch is in the closed position. The switches are mounted on the main sweeper frame in three (3) locations (Fig. 10).

Proximity Switch Operation

The turn around position proximity switch is located on the RH switch plate in the hole identified with number 1. This switch is used to identify the dump hopper turn around height position when the sweeper is offset (not positioned directly behind the tow vehicle). The sensing plate for the turn around position switch is a gusset at the top of the pitch frame.

The transport position proximity switch is located on the RH switch plate in the hole identified with number 3. This switch is used to identify the dump hopper transport height position when the sweeper is positioned directly behind the tow vehicle (not offset). The sensing plate for the transport position switch is a gusset at the top of the pitch frame.

The offset lockout proximity switch is located on the LH switch plate in the hole identified with number 5. This switch is used to prevent the offset operation while the dump hopper is in a raised position. The sensing plate for the offset lockout switch is a pitch frame gusset.

The broom enable proximity switch is located on the LH switch plate in the hole identified with number 7. This switch is used to engage the brush. The sensing plate for the broom enable switch is a pitch frame gusset.

The hitch home proximity switch is located on the front of the frame near the hitch tongue pivot pin. This switch is used to identify when the sweeper is positioned directly behind the tow vehicle (not offset). The sensing plate for the hitch home switch is a plate on the hitch tongue.

Proximity Switch Testing

1. Position sweeper attached to tow vehicle on a level surface with dump hopper empty and sweeper lowered. Engage vehicle parking brake, stop engine and remove key from the ignition switch. Chock sweeper wheels to prevent sweeper from moving.

2. Depending on which proximity switch is to be tested, position the sweeper as listed below (Figs. 11 and 12). In this sweeper position, the LED on cable end of proximity switch **should be** illuminated when electrical power is available to sweeper.

Turn Around Position Switch (hole number 1): Sweeper offset and lowered.

Transport Position Switch (number 3): Sweeper not offset and lowered.

Offset Lockout Switch (number 5): Sweeper lowered.

Broom Enable Switch (number 7): Sweeper lowered.

Hitch Home Switch: Sweeper not offset.

3. Depending on which proximity switch is to be tested, position the sweeper as listed below (Figs. 11 and 12). In this sweeper position, the LED on cable end of proximity switch **should not be** illuminated when electrical power is available to sweeper.

Turn Around Position Switch (hole number 1): Sweeper offset and raised to turn around position.

Transport Position Switch (number 3): Sweeper not offset and raised to transport position.

Offset Lockout Switch (number 5): Sweeper not offset and raised slightly higher than transport position.

Broom Enable Switch (number 7): Sweeper not offset and raised to transport position.

Hitch Home Switch: Sweeper offset.

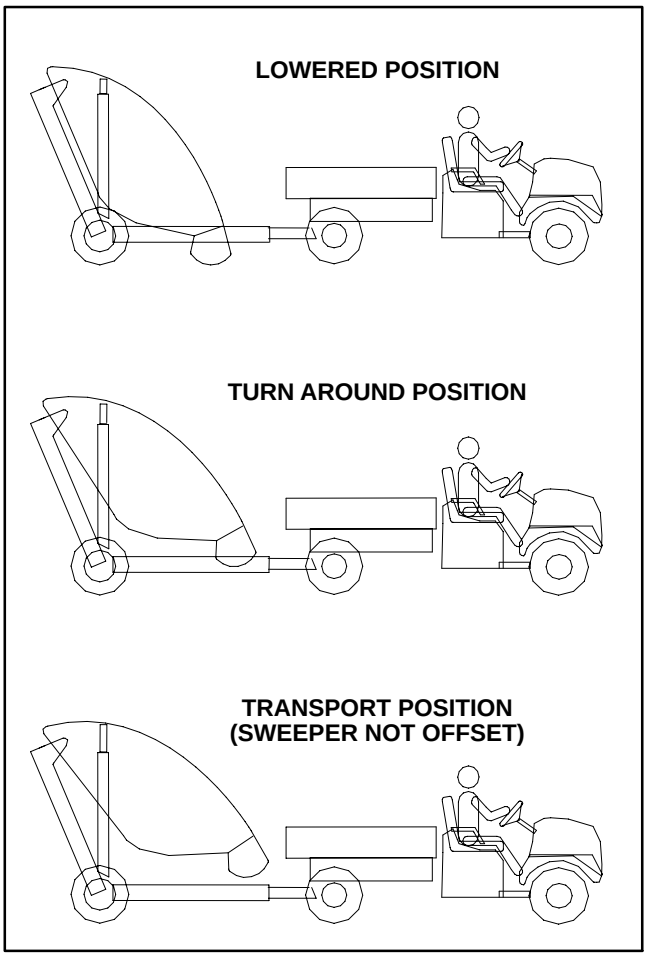

Figure 11

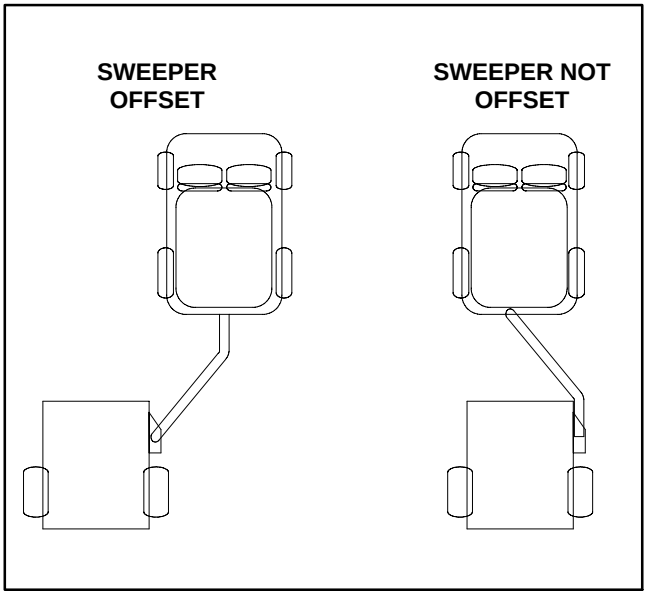

Figure 12

4. If a proximity switch LED does not function correctly:

   A. Disconnect sweeper power harness from tow vehicle. Then, disconnect the proximity switch connector from the sweeper wire harness. Reconnect sweeper power harness to tow vehicle.

   B. Using a multimeter, verify that the sweeper wire harness connector terminal for the appropriate wire has 12 VDC when electrical power exists to sweeper and sweeper is positioned as listed below.

      Turn Around Position Switch (hole number 1): Violet harness wire has 12 VDC when sweeper is lowered and offset.

      Transport Position Switch (number 3): Yellow harness wire has 12 VDC when sweeper is lowered and not offset.

      Offset Lockout Switch (number 5): Pink harness wire has 12 VDC in any sweeper position.

      Broom Enable Switch (number 7): Pink harness wire has 12 VDC in any sweeper position.

      Hitch Home Switch: Pink harness wire has 12 VDC in any sweeper position.

   C. Make sure that gap between end of proximity switch and frame sensing plate is from 0.110" to 0.170" (2.8 to 4.3 mm). If necessary, adjust proximity switch (see Proximity Switches in the Adjustments section).

   D. Make sure that sweeper wire harness ground wire (black) is closed to ground.

   E. If harness wire has system voltage present and gap is correct but switch LED did not function, replace proximity switch. Make sure that switch is properly adjusted (see Proximity Switches in the Adjustments section).

5. After testing is complete, make sure that switch connector is plugged into sweeper wire harness. Connect sweeper power harness to tow vehicle.

PROXIMITY SWITCH STATUS CHART

KEY TO CHART

O	Proximity Switch Open (LED OFF)
X	Proximity Switch Closed (LED ON)

MACHINE FUNCTION / PROXIMITY SWITCH	Turn Around Position Switch (hole 1)	Transport Position Switch (hole 3)	Offset Lockout Switch (hole 5)	Broom Enable Switch (hole 7)	Hitch Home Switch
Sweeper in Offset Position with Sweeper Head Below Turn Around Position	X	O	X	X	O
Sweeper in Offset Position with Sweeper Head At Turn Around Position	O	O	X	O	O
Sweeper NOT in Offset Position with Sweeper Head Below Turn Around Position	O	X	X	X	X
Sweeper NOT in Offset Position with Sweeper Head Between Turn Around and Transport Position	O	X	X	O	X
Sweeper NOT in Offset Position with Sweeper Head At Transport Position	O	O	X	O	X
Sweeper NOT in Offset Position with Sweeper Head Above Transport Position	O	O	O	O	X

Sweeper Head Turn Around Position is from 8 1/2" to 10 1/2" (215.9 to 266.7 mm) from Ground

Sweeper Head Transport Position is from 13 1/4" to 15 1/4" (336.6 to 387.4 mm) from Ground

Solenoid Valve Coil

The hydraulic system on the Pro Sweep uses five (5) solenoid valve coils on the hydraulic control manifold (Fig. 13).

Testing

1. Position sweeper on a level surface with dump hopper lowered. If sweeper is attached to towing vehicle, apply vehicle parking brake, stop engine and remove key from the ignition switch.

2. To ensure that electrical power is removed from Pro Sweep, disconnect sweeper power harness from tow vehicle.

NOTE: The solenoid coil does not have to be removed from the cartridge valve for testing.

3. Unplug wire harness connector from solenoid valve coil.

NOTE: Prior to taking small resistance readings with a digital multimeter, short the test leads together. The meter will display a small resistance value (usually 0.5 ohms or less). This resistance is due to the internal resistance of the meter and test leads. Subtract this value from from the measured value of the component you are testing.

4. Using a multimeter (ohms setting), measure resistance between the two connector terminals on the solenoid coil. The resistance for the solenoid coils is identified below:

Solenoid Coil	Resistance
SV1 (2 coils used)	7.1 ohms
SV2	8.6 ohms
SV3	8.6 ohms
SRV	7.1 ohms

5. If solenoid coil needs replacement, see Solenoid Valve Coil in the Service and Repairs section of this chapter.

6. Connect wire harness connector to the solenoid valve coil.

7. Connect sweeper power harness to tow vehicle.

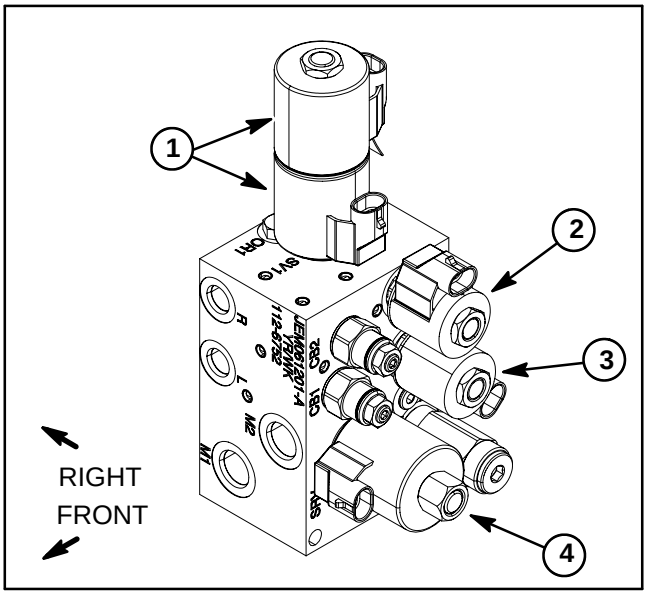

Figure 13

1. **Solenoid SV1**
2. **Solenoid SV2**
3. **Solenoid SV3**
4. **Solenoid SRV**

Remote Transmitter

The remote transmitter (Fig. 14) is a solid state electrical device that sends radio frequency (RF) signal inputs to the sweeper control module for operator control of machine electrical operation. The remote transmitter has sufficient range to send an RF signal to the control module from the tow vehicle operator position.

When a button on the remote transmitter is pressed, the LED on the remote should flicker. If the machine control module is energized (control module Time Out and Power LED's are both illuminated) and a remote transmitter button is pressed, the corresponding control module LED should illuminate and the control module RF activity LED should flicker.

If the control module is energized (control module Time Out and Power LED's are both illuminated) and the tow vehicle hydraulics are engaged, remote button functions are as follows:

Pressing the Sweeper Up button causes the sweeper to raise. The Sweeper Up button can also be used to stop the sweeper from lowering.

Pressing the Sweeper Down button causes the sweeper to lower. Pressing the Sweeper Up or the Stop button will stop the lower function.

Pressing the Offset Right button causes the sweeper to offset to the right. The sweeper will continue to offset until the button is released.

Pressing the Offset Left button causes the sweeper to offset to the left. The sweeper will continue to offset until the button is released.

Pressing the Stop button causes any active function to be disabled.

NOTE: When the stop button on the remote transmitter is pressed, there will be a three (3) second delay before the stop LED on the control module illuminates. Also, for approximately five (5) seconds after the stop button is pressed, the control module stop LED will remain illuminated and no other remote transmitter operations can be performed.

Pressing the Hopper Dump button with the sweeper in the transport position initiates a starting sequence to fully raise the hopper for dumping collected material. This sequence (see Operator's Manual) is necessary to prevent unintentional dumping. After pressing the Hopper Dump button, other transmitter buttons are inactive for approximately five (5) seconds.

The remote transmitter is powered by three (3) AAA alkaline batteries. If the range of the remote transmitter has diminished or the transmitter LED does not flicker when a button is pressed, the batteries should be replaced.

To replace the remote transmitter batteries:

1. Remove six (6) screws that secure the rear cover to the remote transmitter.

2. Lift rear cover from remote transmitter.

3. Remove batteries from remote transmitter and replace with three (3) new AAA alkaline batteries. Make sure to note battery direction when installing batteries in transmitter.

4. Place rear cover on remote transmitter and secure with six (6) screws.

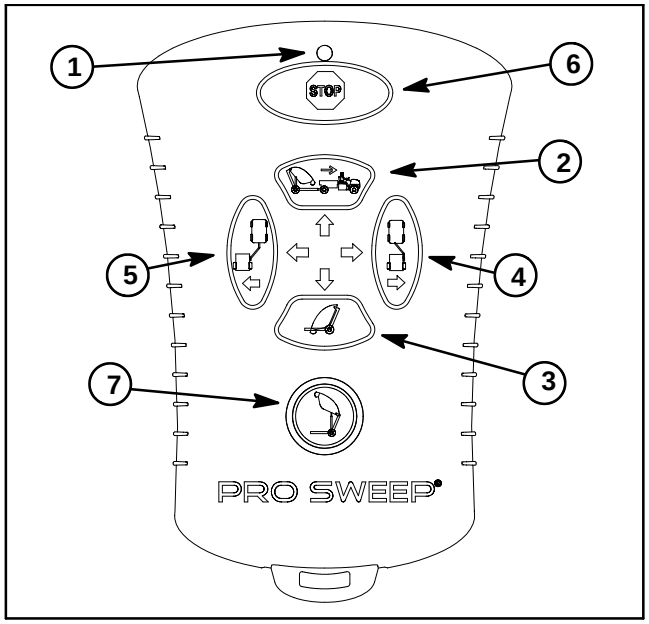

Figure 14

1. **Remote LED**
2. **Sweeper Up button**
3. **Sweeper Down button**
4. **Offset Right button**
5. **Offset Left button**
6. **Stop button**
7. **Hopper Dump button**

Control Module

The control module is a solid state electrical device that receives signal inputs from the remote transmitter and uses those inputs to control sweeper electrical operation. The control module is attached to the frame in front of the RH wheel (Fig. 15).

Inputs from the remote transmitter are monitored by the control module. Output to machine relays and hydraulic solenoid valve coils are controlled based on the inputs received by the control module.

To begin sweeper operation, providing electrical power to the sweeper power harness is used to turn on or “wake up” the control module. The control module Time Out and Power LED’s should both be illuminated during sweeper operation (Fig. 16).

When a remote transmitter button is pressed, the corresponding control module LED should illuminate and the control module RF activity LED should flicker (Fig. 16).

NOTE: Because of the normal RF activity in the environment, the control module RF activity LED may flicker or be illuminated at any time during machine operation. Machine operation will only be controlled by the remote transmitter that is recognized by the control module.

NOTE: When the stop button on the remote transmitter is pressed, there will be a three (3) second delay before the control module stop LED illuminates. Also, the control module stop LED will remain illuminated and no other remote transmitter operations can be performed for approximately five (5) seconds.

The control module includes a timer to allow machine operation for 30 minutes after the last control input (e.g. remote transmitter button pressed). If no inputs are provided to the control module during this time period, the control module will shut off all sweeper electrical power.

The control module does not connect to an external computer or hand held device, cannot be re-programmed and does not record any fault data.

Because of the solid state circuitry built into the control module, there is no reliable method to test it. The module may be damaged if an attempt is made to test it with an electrical test device, such as a digital multimeter.

IMPORTANT: To prevent damage to the Pro Sweep electrical system, disconnect the electrical power harness from the tow vehicle before performing any welding on the machine.

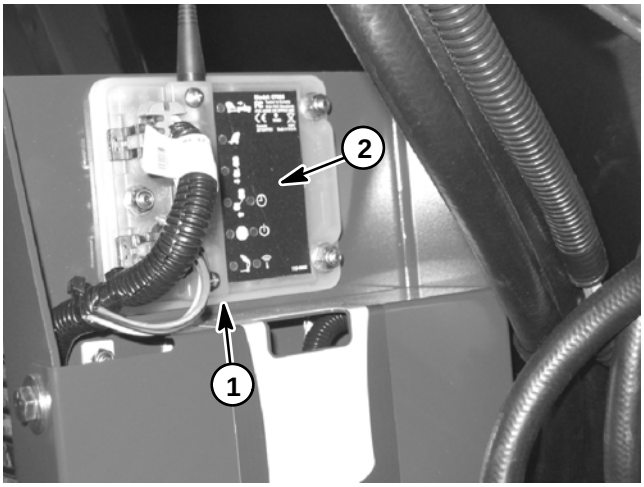

Figure 15

1. **Control module**
2. **LED location**

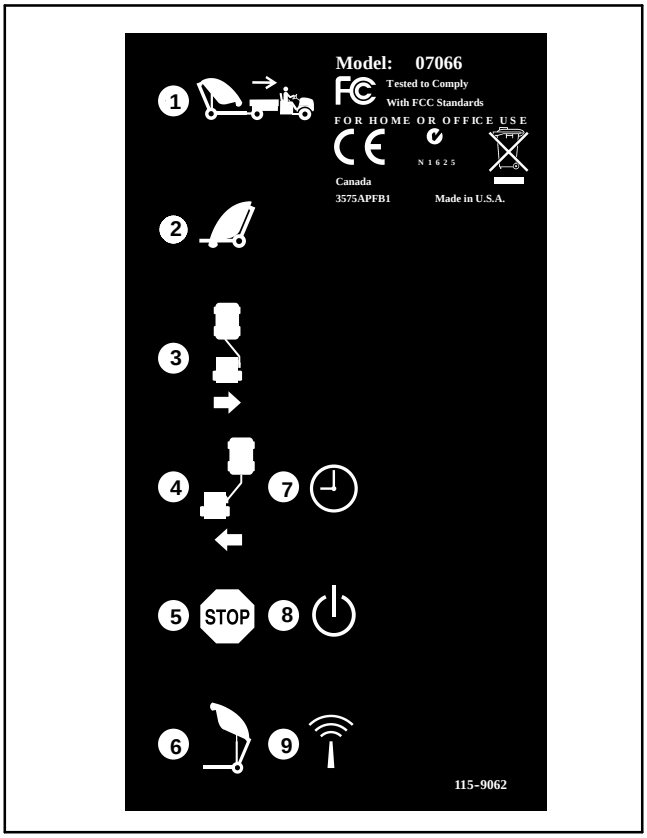

Figure 16

1. **Sweeper up LED**
2. **Sweeper down LED**
3. **Offset right LED**
4. **Offset left LED**
5. **Stop LED**
6. **Hopper dump LED**
7. **Time out LED**
8. **Power LED**
9. **RF activity LED**

Solenoid Valve Coil

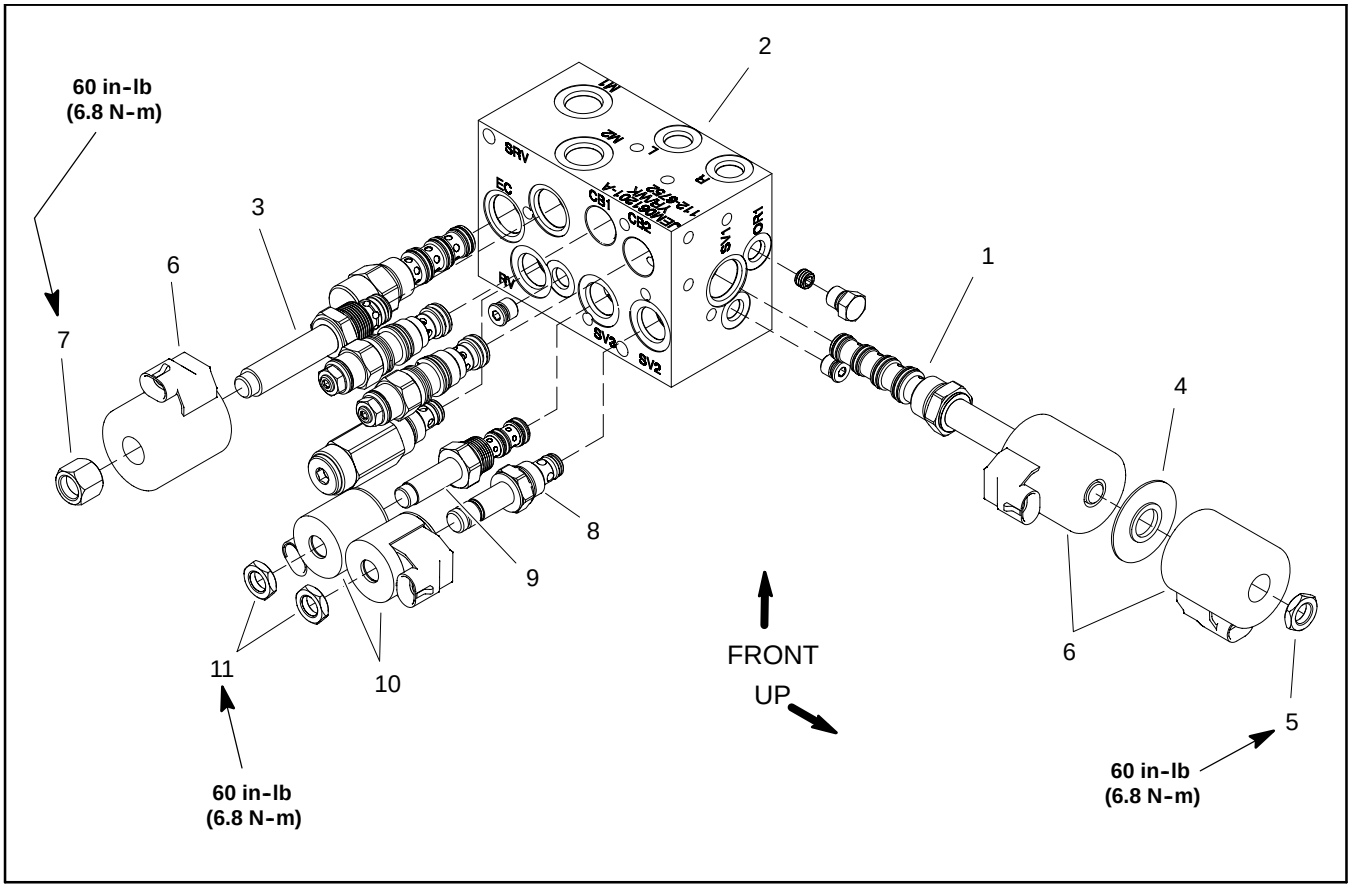

Figure 17

1. **Solenoid valve (SV1)**
2. **Hydraulic manifold**
3. **Solenoid relief valve (SRV)**
4. **Coil spacer**
5. **Nut**
6. **Solenoid coil**
7. **Nut**
8. **Solenoid valve (SV2)**
9. **Solenoid valve (SV3)**
10. **Solenoid coil**
11. **Nut**

The solenoid valve coils on the hydraulic control manifold (Fig. 17) can be removed and installed without opening the hydraulic system.

Removal

1. Position sweeper on a level surface with dump hopper lowered. If sweeper is attached to towing vehicle, apply vehicle parking brake, stop engine and remove key from the ignition switch.

2. To ensure that electrical power is removed from Pro Sweep, disconnect sweeper power harness from tow vehicle.

3. Disconnect the machine wire harness electrical connector from the solenoid coil to be removed.

4. Remove the nut from the cartridge valve.

5. Slide the solenoid coil from the cartridge.

6. Clean all corrosion or dirt from the cartridge stem.

Installation

1. Slide solenoid coil onto the cartridge stem.

2. Install the nut onto the cartridge and torque nut **60 in-lb (6.8 N-m)** (do not over tighten).

3. Connect the machine wire harness electrical connector to the solenoid coil.

Chapter 5

Chassis

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- Frame Assembly 16

Specifications

Item	Description
Tires Size Pressure	 26.5 x 14 – 12, 4 Ply, Tubeless 12.5 PSI (86 kPa)
Wheel Lug Nut Torque	70 to 90 ft–lb (95 to 122 N–m)

General Information

Operator's Manual

The Operator's Manual provides information regarding the operation, general maintenance and maintenance intervals for your Pro Sweep machine. Refer to that publication for additional information when servicing the machine.

Securing Pro Sweep to Tow Vehicle

While operating or servicing the Pro Sweep, make sure that hitch pin is properly positioned in tow vehicle hitch and sweeper tongue. Hitch pin should be secured with hairpin clip (Fig. 1).

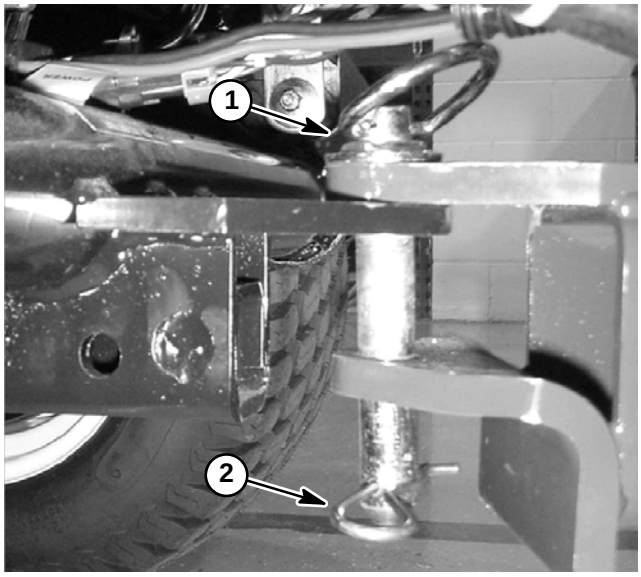

Figure 1

1. **Hitch pin**
2. **Hairpin clip**

Wheels

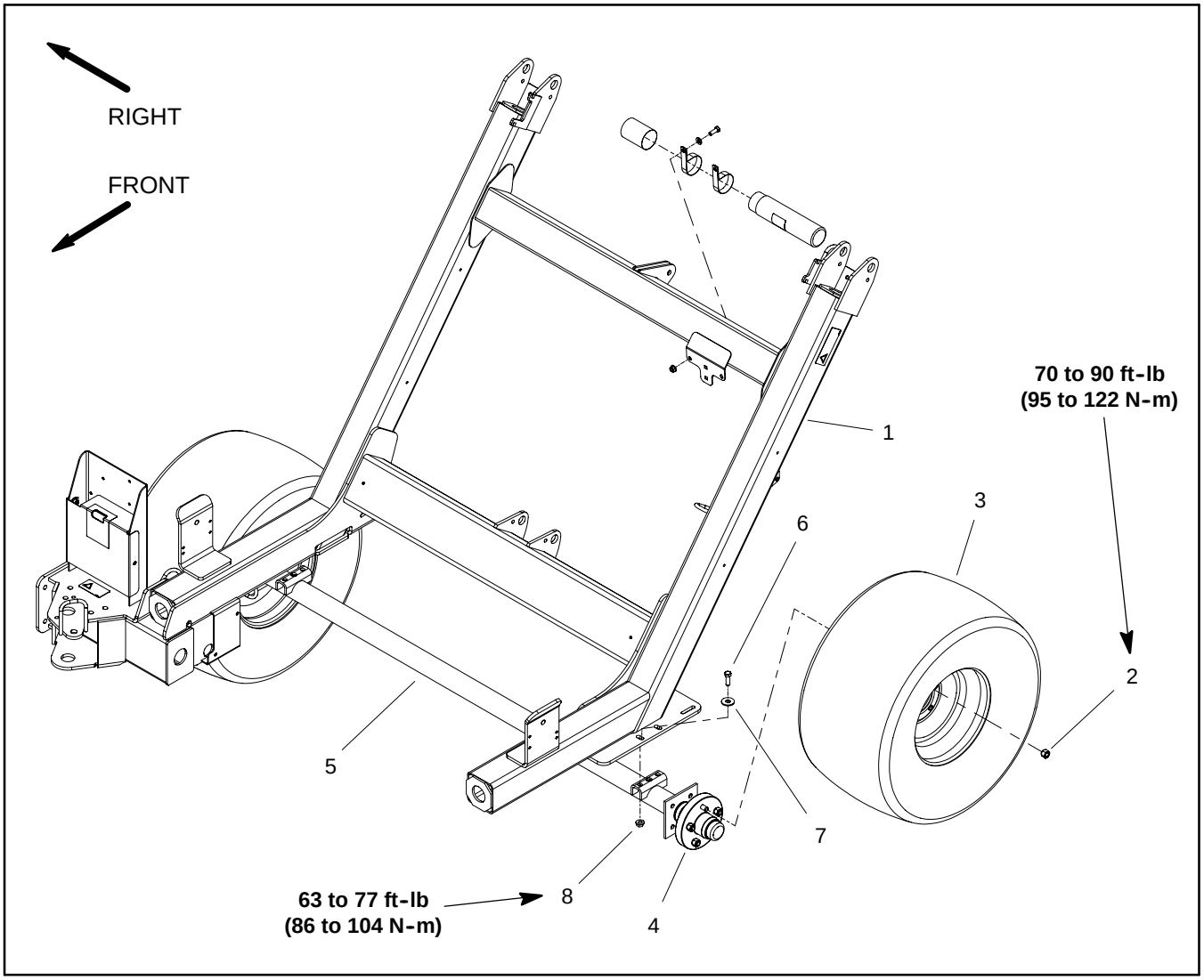

Figure 2

1. **Main frame**
2. **Lug nut (5 used per wheel)**
3. **Wheel and tire assembly**
4. **Wheel hub**
5. **Axle**
6. **Cap screw (4 used)**
7. **Support washer (4 used)**
8. **Flange nut (4 used)**

Wheel Removal (Fig. 2)

1. Position sweeper on a level surface with dump hopper empty and lowered. Have sweeper attached to towing vehicle, apply vehicle parking brake, stop engine and remove key from the ignition switch. Chock sweeper wheels to prevent sweeper from moving.

2. Jack or hoist sweeper from ground and support machine with appropriate jack stands (see Operator's Manual and Jacking Instructions in Chapter 1 – Safety).

3. Loosen and remove five (5) lug nuts from wheel to be removed.

4. Pull wheel from sweeper.

Wheel Installation (Fig. 2)

1. Position wheel to wheel hub.

2. Secure wheel to sweeper with five (5) lug nuts.

3. Carefully lower machine to ground.

WARNING

Failure to maintain proper lug nut torque could result in failure or loss of wheel and may result in personal injury.

4. Torque lug nuts in a criss–cross pattern from **70 to 90 ft–lb (95 to 122 N–m)**.

Wheel Bearings

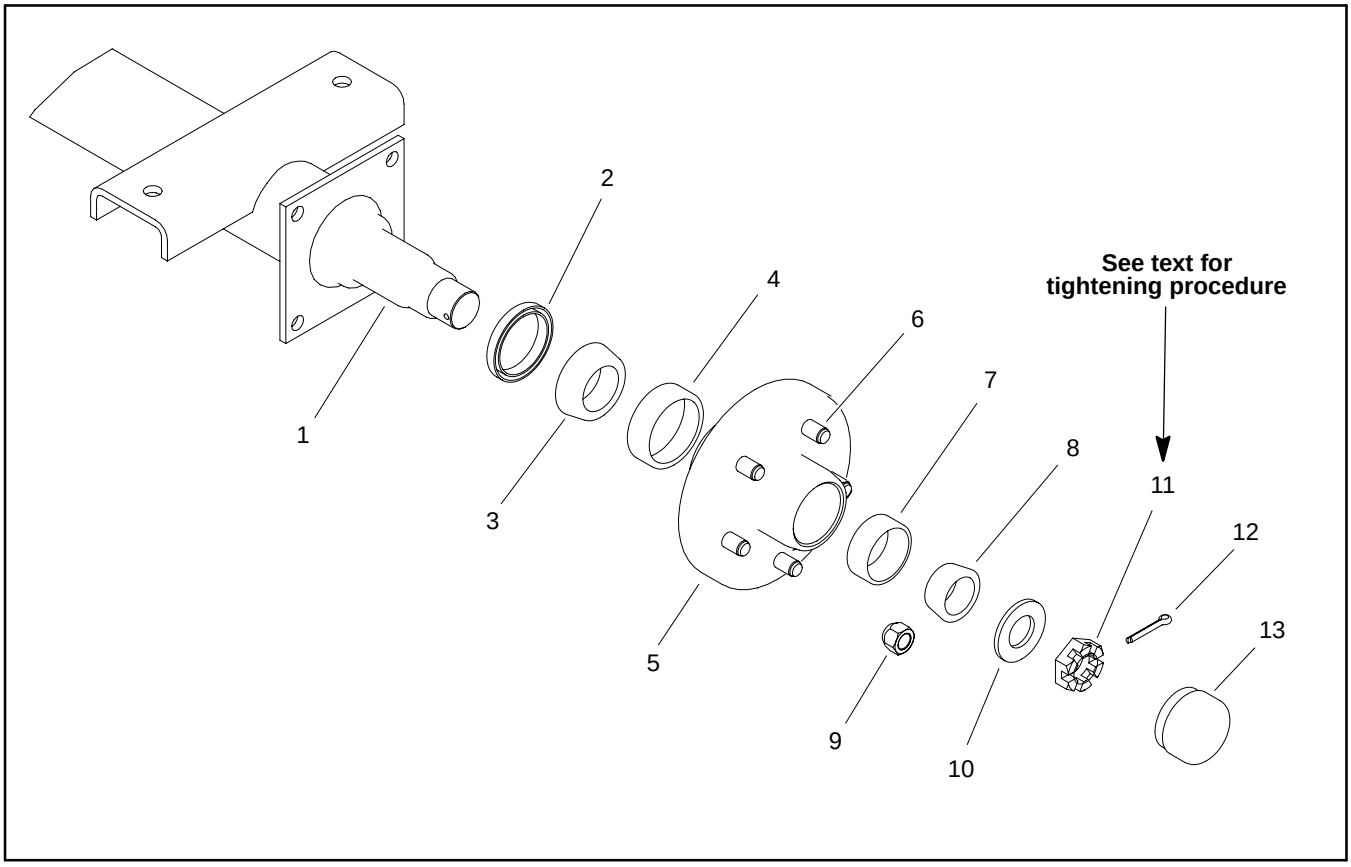

Figure 3

1. **Axle**
2. **Grease seal**
3. **Inner bearing cone**
4. **Inner bearing cup**
5. **Wheel hub**
6. **Lug bolt (5 used)**
7. **Outer bearing cup**
8. **Outer bearing cone**
9. **Lug nut (5 used)**
10. **Washer**
11. **Slotted hex nut**
12. **Cotter pin**
13. **Dust cup**

Removal (Fig. 3)

1. Position sweeper on a level surface with dump hopper empty and lowered. Have sweeper attached to towing vehicle, apply vehicle parking brake, stop engine and remove key from the ignition switch. Chock sweeper wheels to prevent sweeper from moving.

2. Jack or hoist sweeper from ground and support machine with jack stands (see Operator's Manual and Jacking Instructions in Chapter 1 – Safety).

3. Remove wheel assembly (see Wheel Removal in this section).

4. Carefully pry dust cap from wheel hub.

5. Remove cotter pin from axle spindle.

6. Remove slotted hex nut and washer that secures wheel hub to spindle. Slide wheel hub with bearings from spindle.

7. Disassemble wheel hub:

   A. Pull grease seal out of the wheel hub. Discard seal.

   B. Remove bearing cones from both sides of wheel hub. Clean bearings in solvent. Clean inside of hub.

   C. If necessary, remove bearing cups from hub using a hammer and punch. Take care to not damage hub as bearing cups are removed.

   D. Inspect wheel bearings. Check the bearing cones and bearing cups for wear, pitting or other damage. Replace worn or damaged parts.

   E. If necessary, use a press to remove lug bolts from hub.

Installation (Fig. 3)

1. Clean all parts thoroughly before reassembly.

2. Assemble wheel hub:

   A. If bearing cups were removed from the wheel hub, press inner and outer cups into the hub until they seat against the hub shoulder.

   B. If lug bolts were removed from hub, press new bolts into hub. Make sure that head of bolt is fully to hub surface.

   C. Pack both bearing cones with grease. Install greased inner bearing into the cup on inboard side of the wheel hub.

   D. Fill hub approximately 50% full of grease.

   IMPORTANT: The grease seal must be pressed in so it is flush with the end of the hub. The lip of the seal must face the bearing.

   E. Lubricate the inside of a new grease seal and press it into the wheel hub.

3. Install the wheel hub onto the axle spindle taking care to not damage grease seal in wheel hub.

4. Install greased outer bearing cone, washer and slotted hex nut onto spindle shaft.

5. While rotating the wheel hub by hand, torque the slotted hex nut from **75 to 180 in-lb (8.5 to 20.3 N-m)** to seat bearings. Loosen nut until it is away from washer and hub has end play. Finally, while rotating hub, tighten slotted hex nut from **15 to 20 in-lbs (1.7 to 2.3 N-m)**.

6. Install cotter pin through axle spindle hole. Install dust cap to hub.

WARNING

Failure to maintain proper lug nut torque could result in failure or loss of wheel and may result in personal injury.

7. Install wheel assembly (see Wheel Installation in this section).

8. Carefully lower machine to ground. Make sure that lug nuts are torqued in a criss-cross pattern from **70 to 90 ft-lb (95 to 122 N-m)**.

Servicing the Brush Housing

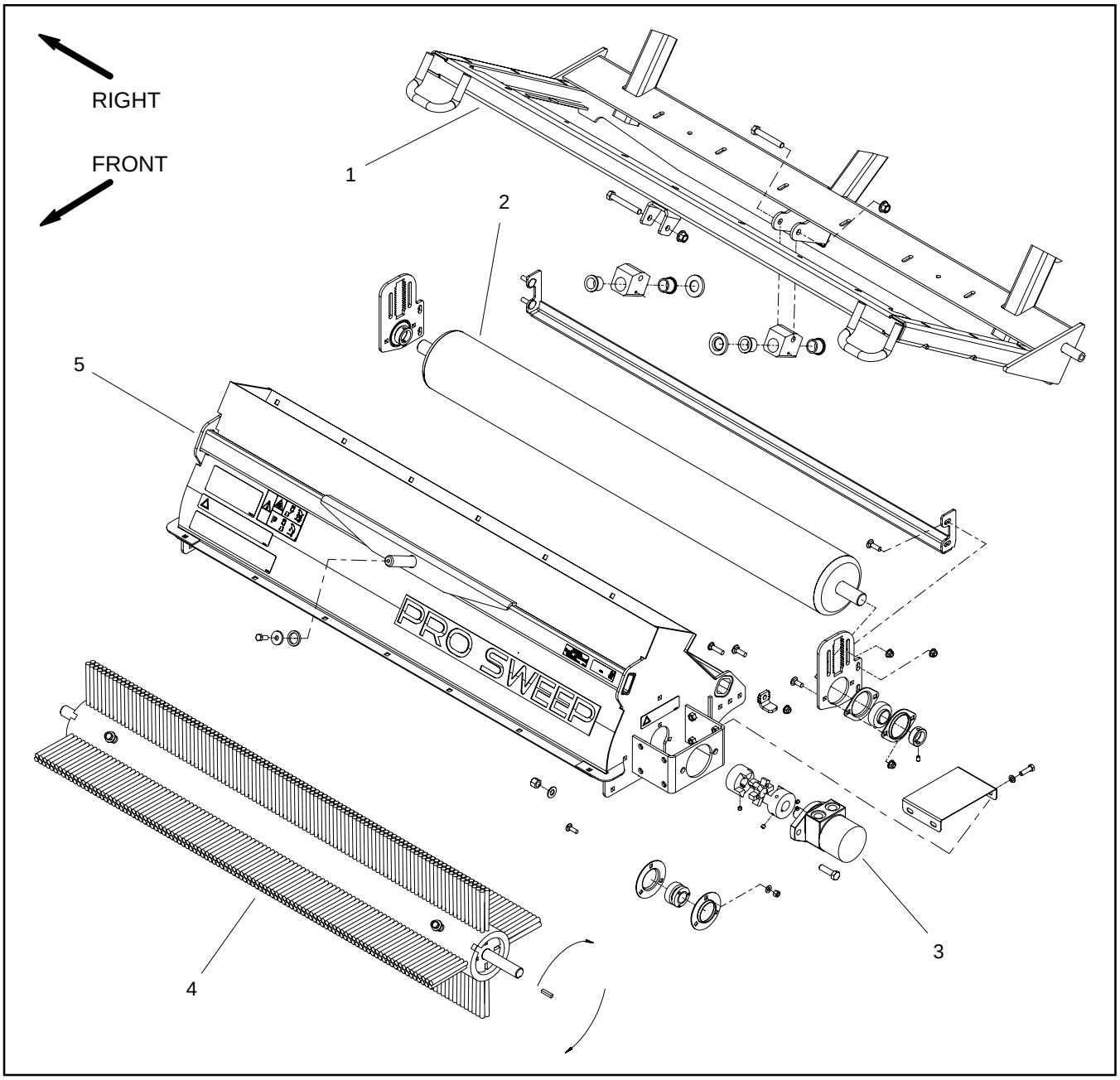

Figure 4

1. **Saddle frame**
2. **Roller**
3. **Hydraulic brush motor**
4. **Brush**
5. **Brush housing**

To perform service on the brush housing, brush assembly or roller, the following procedure can be used. These steps will reduce the chance that brush housing components will fall or shift during the service process.

1. Position sweeper on a level surface with dump hopper empty and lowered. Have sweeper attached to towing vehicle, apply vehicle parking brake, stop engine and remove key from the ignition switch. Chock sweeper wheels to prevent sweeper from moving.

2. With brush housing resting on the ground, remove fasteners that secure component(s) that are to be removed (see Brush, Brush Housing and/or Roller in this section).

3. Support component(s) to prevent it (them) from shifting position.

4. Start tow vehicle. Slowly raise sweeper hopper while allowing brush housing component(s) to remain on the ground.

5. Raise hopper and place cylinder stop on lift cylinder to secure sweeper frame.

6. Perform necessary service on removed component(s).

7. Once necessary service has been completed, position serviced component(s) under raised hopper.

8. Remove cylinder stop from lift cylinder. Slowly lower hopper to correctly position component(s) to be installed.

9. Install component(s) to machine (see Brush, Brush Housing and/or Roller in this section).

Brush

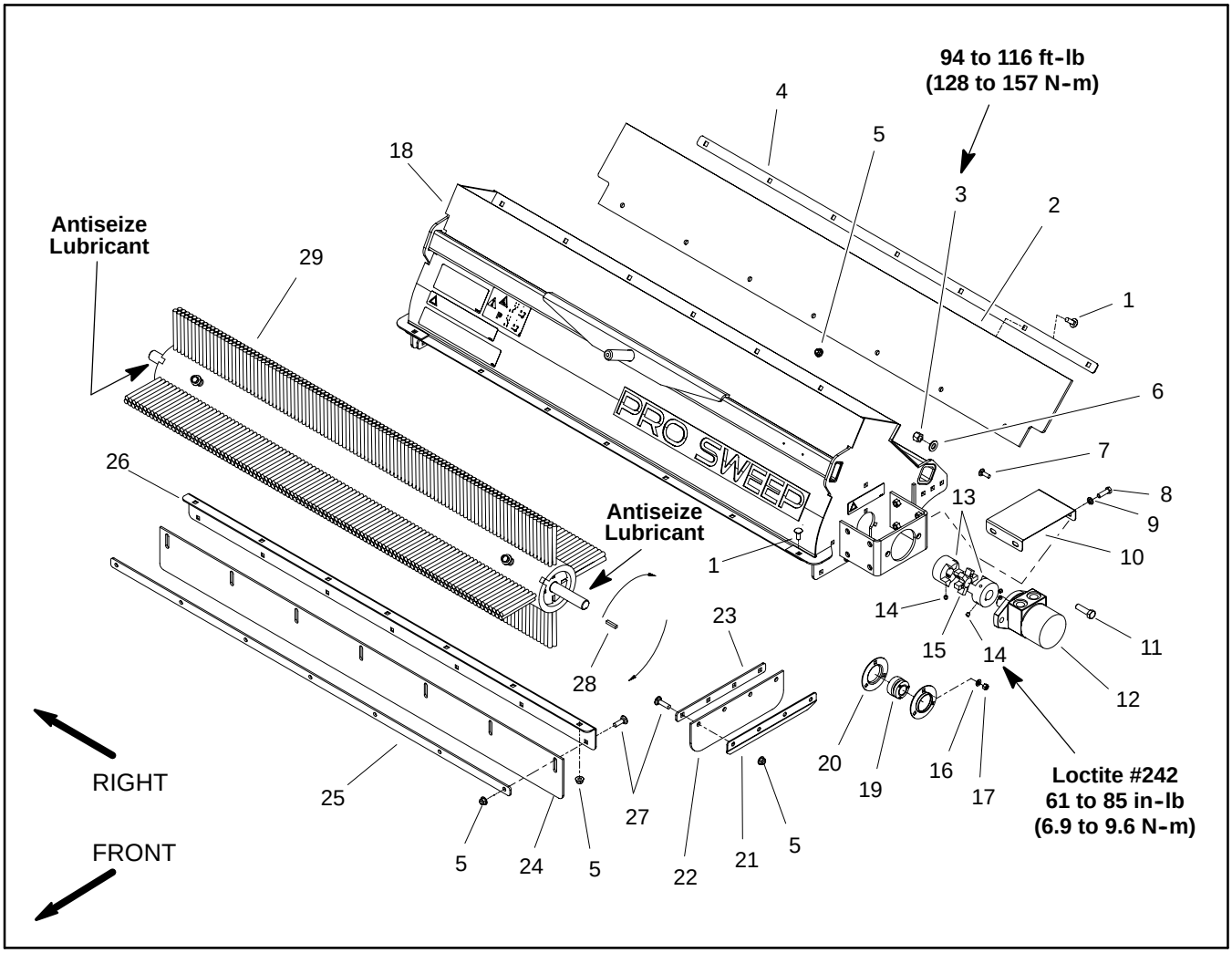

Figure 5

1. Carriage screw
2. Top rubber shield
3. Lock nut (2 used)
4. Top shield plate
5. Flange nut
6. Flat washer (2 used)
7. Carriage bolt (3 used per bearing)
8. Cap screw (4 used per cover)
9. Lock washer (4 used per cover)
10. Coupler cover (2 used)
11. Cap screw (2 used)
12. Hydraulic brush motor
13. Coupler jaw
14. Set screw (2 used per jaw)
15. Coupler spider
16. Flat washer (3 used per bearing)
17. Lock nut (3 used per bearing)
18. Brush housing
19. Bearing assembly
20. Bearing flange (2 used per bearing)
21. Side angle plate (2 used)
22. Side rubber shield (2 used)
23. Side shield plate (2 used)
24. Front rubber shield
25. Front shield plate
26. Front angle plate
27. Carriage screw
28. Square key
29. Brush assembly

Removal (Fig. 5)

1. Position sweeper on a level surface with dump hopper empty and lowered. Have sweeper attached to towing vehicle, apply vehicle parking brake, stop engine and remove key from the ignition switch. Chock sweeper wheels to prevent sweeper from moving.

2. Remove hydraulic brush motor from brush housing (see Hydraulic Brush Motor Removal in the Service and Repairs section of Chapter 3 – Hydraulic System). Remove coupler spider (item 15).

3. Loosen set screws (item 14) that secure coupling jaw to brush shaft. Slide coupling jaw from shaft. Locate and retrieve square key from brush shaft.

NOTE: If desired, brush housing (with brush installed) can be removed from sweeper to allow brush removal (see Brush Housing Removal in this section).

4. Remove carriage bolts (item 7), flat washers (item 16) and lock nuts (item 17) that secure bearing flanges to brush housing.

5. Support brush assembly to prevent it from moving. Follow Servicing the Brush Housing procedure in this section to remove brush from brush housing.

6. After raising hopper and placing lift cylinder stop, retrieve brush assembly from under machine.

7. Loosen three (3) set screws that secure bearings to brush shaft. Slide bearing and bearing flanges from both ends of shaft.

8. Disassemble brush using Figure 6 as a guide.

Installation (Fig. 5)

1. Assemble brush using Figure 6 as a guide. Torque flange nuts from **27 to 33 ft-lb (37 to 44 N-m)**.

2. Thoroughly clean brush shaft surface. If necessary, remove nicks or burrs on shaft with emery cloth or fine file. Apply antiseize lubricant to shaft.

3. Slide bearing flanges and bearing assembly to each end of brush shaft with bearing set screws orientated to outside of brush. Do not tighten bearing set screws at this time.

4. Position brush assembly under raised hopper.

5. Slowly lower hopper to position brush assembly to brush housing (see Servicing the Brush Housing in this section).

6. Secure bearing flanges to brush housing with carriage bolts (item 7), flat washers (item 16) and lock nuts (item 17). Center brush between bearings.

7. Secure the bearings to the brush shaft as follows:

A. Position the bearing collar so that a set screw is directly opposite the split in the bearing sleeve. Tighten three (3) set screws in bearing so that they are finger tight. Make sure that brush is still centered between bearings.

B. Starting with the set screw that is opposite from the split in the sleeve, tighten all set screws 1/4 turn.

C. Again, starting with the set screw that is opposite from the split in the sleeve, tighten all set screws an additional 1/4 turn.

NOTE: A replacement bearing includes an allen wrench and torque indicator that can be used to properly torque bearing set screws. When tightening set screws, the torque is correct when the long end of the allen wrench contacts the torque indicator.

D. Finally, starting with the set screw that is opposite from the split in the sleeve, torque all set screws **66 in-lb (7.5 N-m)**.

8. Position square key in brush shaft. Slide coupling jaw onto drive end of brush shaft.

9. Place coupler spider into coupling jaw on brush shaft.

10. Install hydraulic brush motor to brush housing (see Hydraulic Brush Motor Installation in the Service and Repairs section of Chapter 3 – Hydraulic System).

11. Make sure that coupling jaws have a gap between coupler jaw valleys from 0.830" to 0.930" (21.1 to 23.6 mm). Apply Loctite #242 (or equivalent) to threads of coupling set screws. Secure coupling jaws to motor shaft and brush shaft by torquing set screws from **61 to 85 in-lb (6.9 to 9.6 N-m)** (Fig. 7).

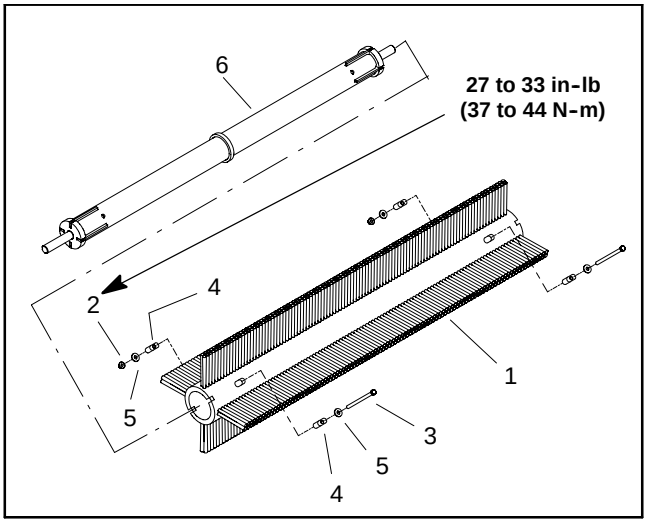

Figure 6

1. **Brush**
2. **Flange nut (2 used)**
3. **Cap screw (2 used)**
4. **Key (4 used)**
5. **Washer (4 used)**
6. **Brush axle**

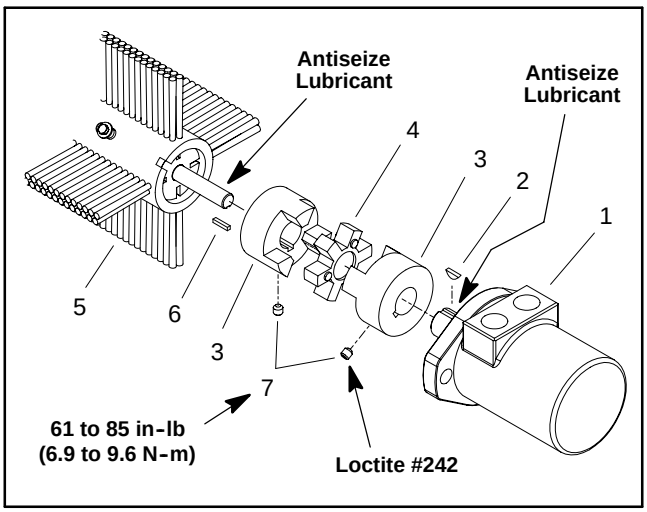

Figure 7

1. **Hydraulic brush motor**
2. **Key**
3. **Coupling jaw**
4. **Coupling spider**
5. **Brush**
6. **Square key**
7. **Set screw (2 per jaw)**

Brush Housing

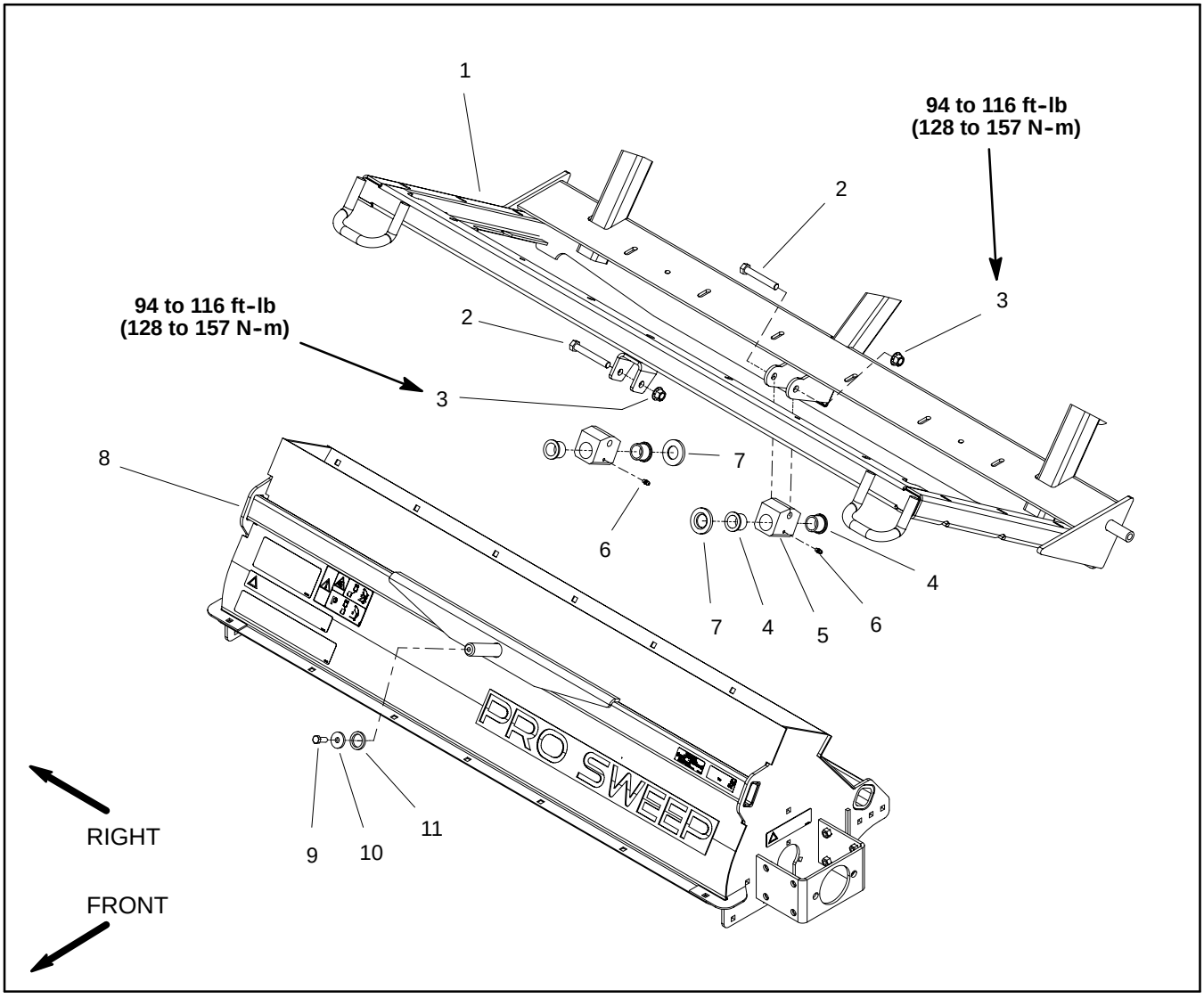

Figure 8

1. **Saddle frame**
2. **Cap screw**
3. **Lock nut**
4. **Flange bushing (2 used per mount)**
5. **Pivot mount (2 used)**
6. **Grease fitting (1 used per mount)**
7. **Thrust washer**
8. **Brush housing**
9. **Cap screw**
10. **Flat washer**
11. **Hardened spacer**

Removal (Fig. 8)

1. Position sweeper on a level surface with dump hopper empty and lowered. Have sweeper attached to towing vehicle, apply vehicle parking brake, stop engine and remove key from the ignition switch. Chock sweeper wheels to prevent sweeper from moving.

2. Remove hydraulic brush motor from brush housing (see Hydraulic Brush Motor Removal in the Service and Repairs section of Chapter 3 – Hydraulic System).

3. Support brush housing to prevent it from shifting.

4. Remove cap screws (item 2) and lock nuts (item 3) that secure pivot mounts to frame.

5. Follow Servicing the Brush Housing procedure in this section to remove brush housing from saddle frame.

6. After raising hopper and placing lift cylinder stop, retrieve brush housing from under machine.

7. Remove cap screw (item 9), flat washer (item 10) and hardened spacer (item 11) from front brush housing pin.

8. Remove pivot mounts from brush housing. Locate and retrieve thrust washers (item 7) from between pivot mount and brush housing.

9. If necessary, remove flange bushings from pivot mounts. Discard bushings if removed.

Installation (Fig. 8)

1. If flange bushings were removed from pivot mounts, press new bushings fully into mounts.

2. Place thrust washer and then pivot mount on both brush housing pins.

3. Secure front pivot mount with hardened spacer (item 11), flat washer (item 10) and cap screw (item 9).

4. Position brush housing under raised hopper.

5. Slowly lower hopper to position saddle frame to brush housing (see Servicing the Brush Housing in this section).

6. Secure pivot mounts to frame with cap screws (item 2) and lock nuts (item 3). Torque lock nuts from **94 to 116 ft-lb (128 to 157 N-m)**.

7. Install hydraulic brush motor to brush housing (see Hydraulic Brush Motor Installation in the Service and Repairs section of Chapter 3 – Hydraulic System). Make sure that coupling jaws have a gap between coupler jaw valleys from 0.830" to 0.930" (21.1 to 23.6 mm). Apply Loctite #242 (or equivalent) to threads of coupling set screws. Secure coupling jaws to motor shaft and brush shaft by torquing set screws from **61 to 85 in-lb (6.9 to 9.6 N-m)** (Fig. 9).

8. Lubricate grease fittings on pivot mounts.

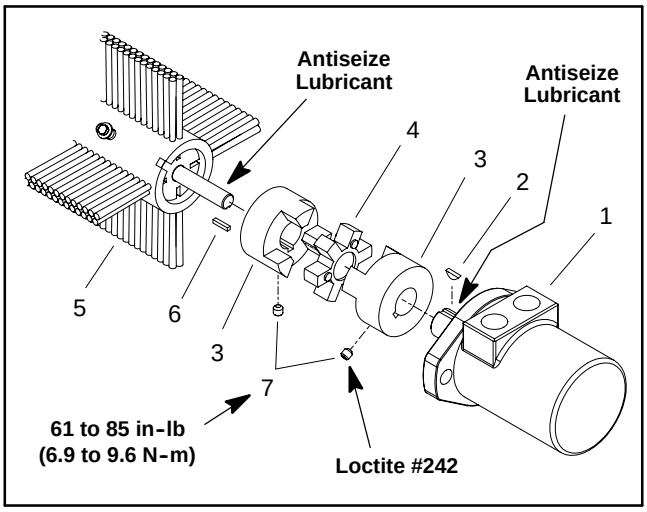

Figure 9

1. **Hydraulic brush motor**
2. **Key**
3. **Coupling jaw**
4. **Coupling spider**
5. **Brush assembly**
6. **Square key**
7. **Set screw (2 per jaw)**

Roller

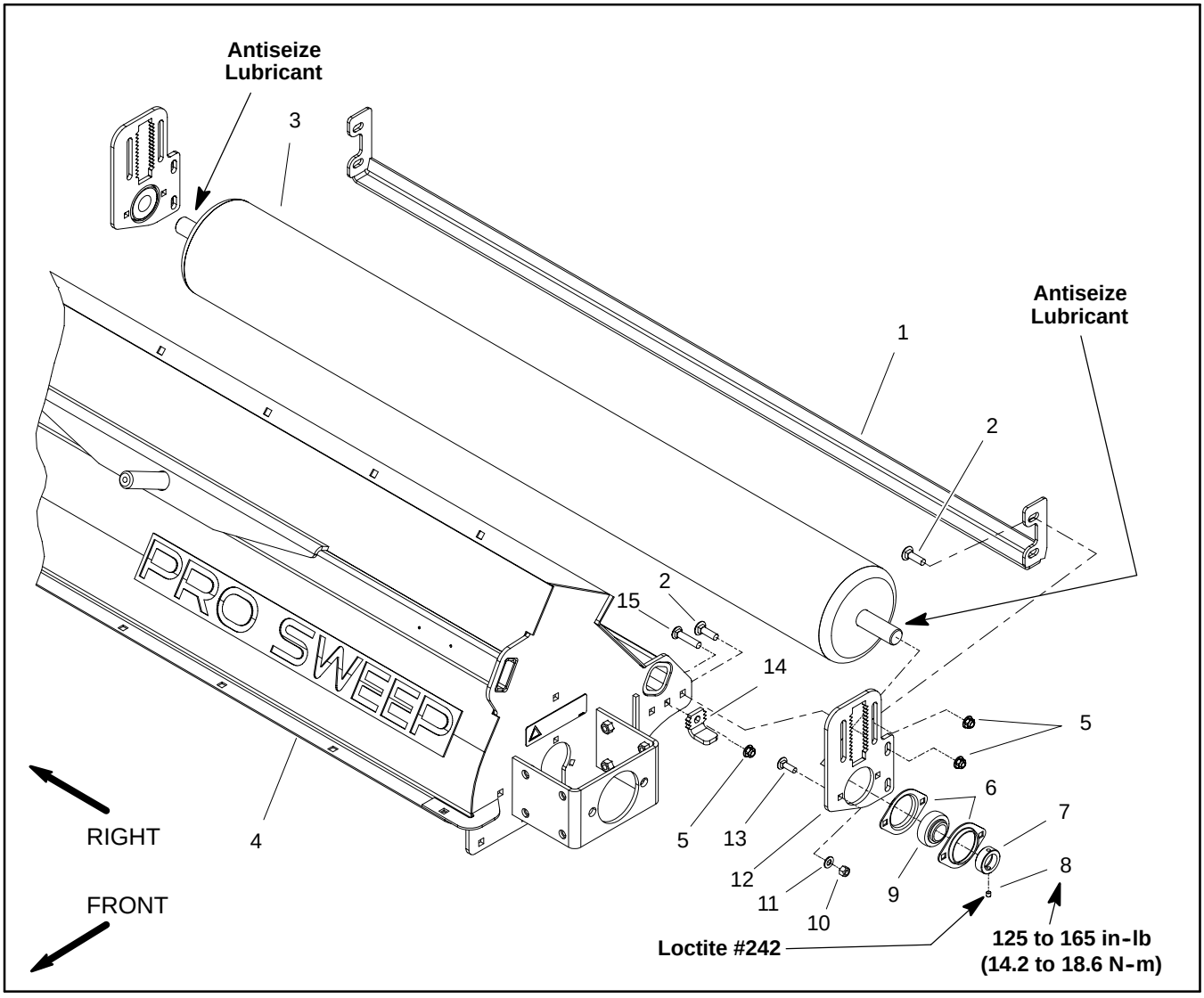

Figure 10

1. Roller scraper
2. Carriage screw (8 used)
3. Roller
4. Brush housing
5. Flange nut (10 used)
6. Bearing flange (2 used per bearing)
7. Locking collar (2 used)
8. Set screw (1 per collar)
9. Bearing (2 used)
10. Lock nut (2 used per bearing)
11. Flat washer (2 used per bearing)
12. Roller adjustment plate (2 used)
13. Carriage screw (2 used per bearing)
14. Adjuster key (2 used)
15. Carriage screw (2 used)

Removal (Fig. 10)

1. Position sweeper on a level surface with dump hopper empty and lowered. Have sweeper attached to towing vehicle, apply vehicle parking brake, stop engine and remove key from the ignition switch. Chock sweeper wheels to prevent sweeper from moving.

2. Remove flange nuts and carriage screws that secure roller scraper to roller adjustment plates. Remove roller scraper from machine.

IMPORTANT: When fully lowered, the sweeper is supported by the roller. To service the roller, raise the sweeper slightly before carefully loosening fasteners that secure roller assembly.

CAUTION

To prevent personal injury, make sure that roller is supported as it is removed from the machine. Roller weighs approximately 80 pounds (36.3 kg).

3. Support roller to prevent it from shifting.

4. Note location of roller adjustment plates and adjuster keys for reassembly purposes.

5. Remove flange nuts that secure roller adjustment plates and adjuster keys to brush housing.

6. Refer to Brush Housing Service in this section for procedure to remove roller assembly from brush housing.

7. After raising hopper and placing lift cylinder stop, retrieve roller assembly from under machine.

8. To remove bearings from roller:

   A. Remove set screw (item 8) that secures locking collar to roller shaft.

   NOTE: Normal roller rotation is counter–clockwise as viewed from left side of sweeper.

   B. Using a punch and hammer, rotate locking collar (item 7) in the opposite direction of normal roller rotation to loosen collar.

   C. Remove carriage screws (item 13), flat washers (item 11) and lock nuts (item 10) that secure bearing flanges to roller adjustment plate.

   D. Slide bearing flanges, locking collar and bearing from roller.

Installation (Fig. 10)

1. Clean roller shaft ends and apply antiseize lubricant to shaft ends. Place adjustment plate, bearing flanges, bearing and locking collar onto each end of roller shaft. Do not tighten set screws in locking collars.

2. Secure bearing flanges to roller adjustment plate with carriage screws (item 13), flat washers (item 11) and lock nuts (item 10).

3. Position roller assembly under raised hopper.

4. Slowly lower hopper to position roller assembly to housing (see Servicing the Brush Housing in this section).

5. Secure adjustment plates and adjuster keys to brush housing with carriage screws and flange nuts using location noted during removal.

6. Center roller between bearings.

NOTE: Normal roller rotation is counter–clockwise as viewed from left side of sweeper.

7. Using a punch and hammer, rotate locking collars in the direction of normal roller rotation to tighten collars.

8. Apply Loctite #242 (or equivalent) to threads of set screws (item 8). Install set screws into collars and torque from **125 to 165 in–lb (14.2 to 18.6 N–m)** to secure locking collars to roller shaft.

9. Check that roller is free to rotate and no binding exists.

10. Position roller scraper to machine. Install carriage screws and flange nuts that secure roller scraper to roller adjustment plates.

11. Check roller height and roller scraper clearance and adjust if necessary (see Operator's Manual).

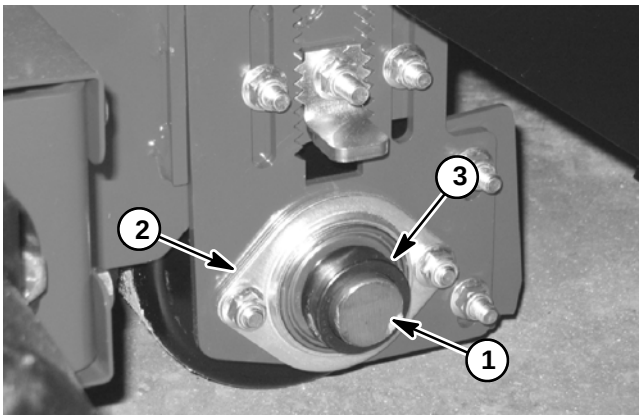

Figure 11

1. **Roller shaft**
2. **Bearing flange**
3. **Locking collar**

Frame Assembly

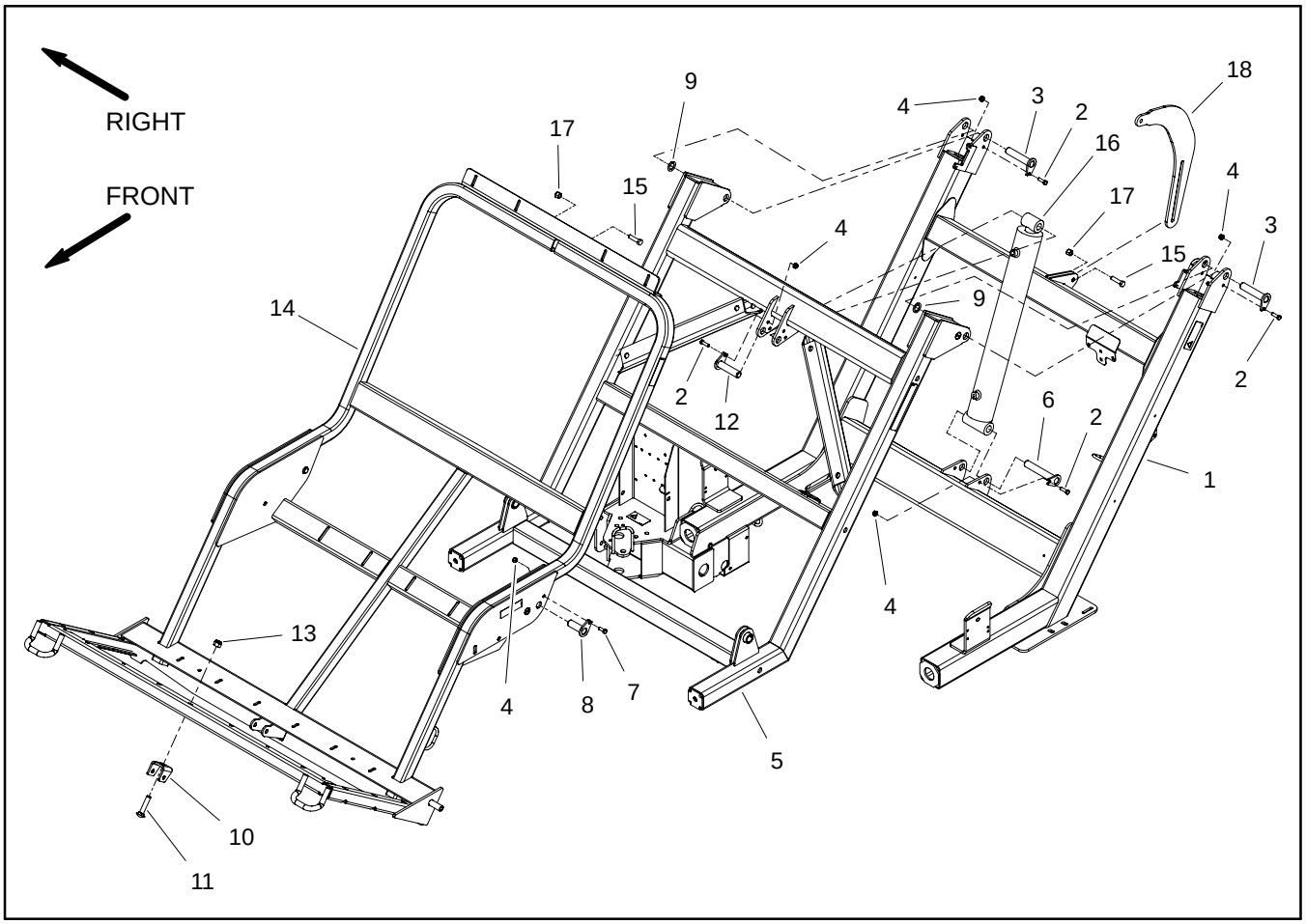

Figure 12

1. **Main frame**
2. **Cap screw (4 used)**
3. **Pivot pin (2 used)**
4. **Flange nut (6 used)**
5. **Pitch frame**
6. **Pivot pin**
7. **Cap screw (2 used)**
8. **Pivot pin (2 used)**
9. **Hardened spacer (2 used)**
10. **Pivot saddle**
11. **Carriage bolt**
12. **Pivot pin**
13. **Lock nut**
14. **Saddle frame**
15. **Cap screw**
16. **Lift cylinder**
17. **Lock nut**
18. **Link**

Disassembly (Fig. 12)

1. Position sweeper on a level surface with dump hopper empty and lowered. Have sweeper attached to towing vehicle, engage vehicle parking brake, stop engine and remove key from the ignition switch. Chock sweeper wheels to prevent sweeper from moving.

NOTE: If lift cylinder is to be removed, see Lift Cylinder Removal in the Service and Repairs section of Chapter 3 – Hydraulic System.

2. Disassemble frame as needed using Figure 12 as a guide.

Assembly (Fig. 12)

1. Assemble frame using Figure 12 as a guide.

2. Lubricate pivot point grease fittings.

Chapter 6

Electrical Diagrams

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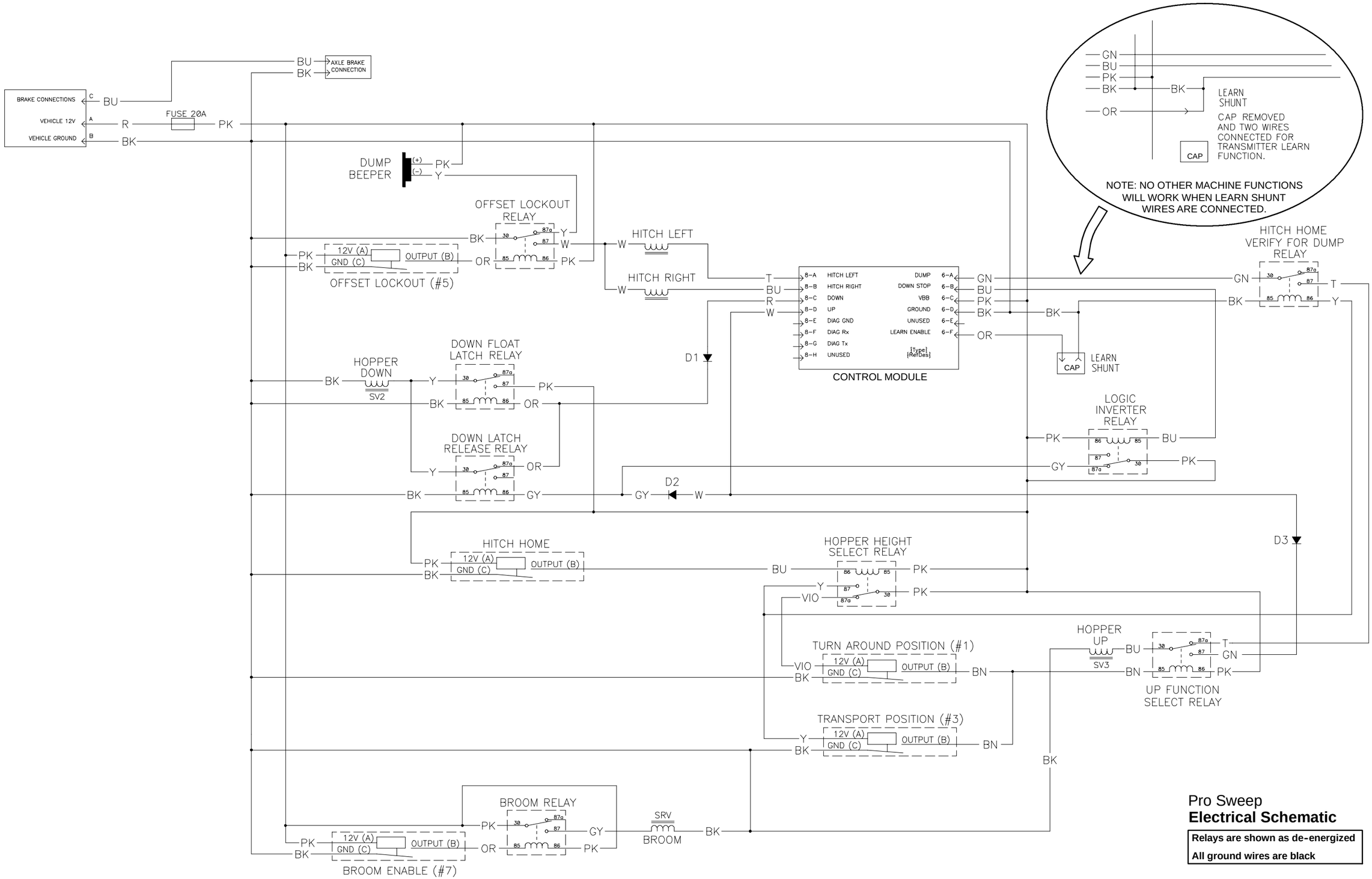
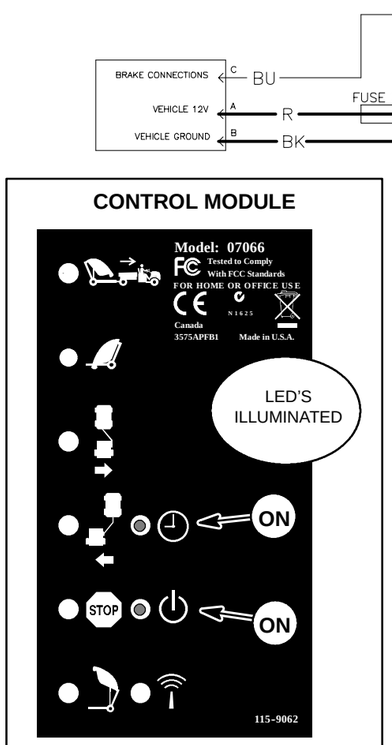


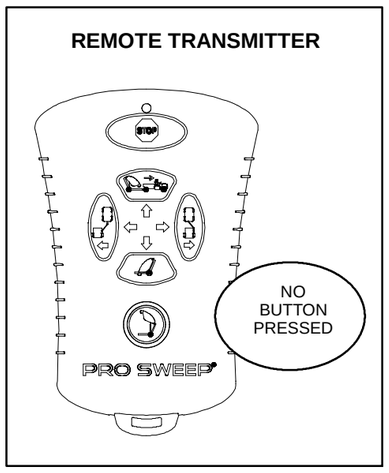
Pro Sweep

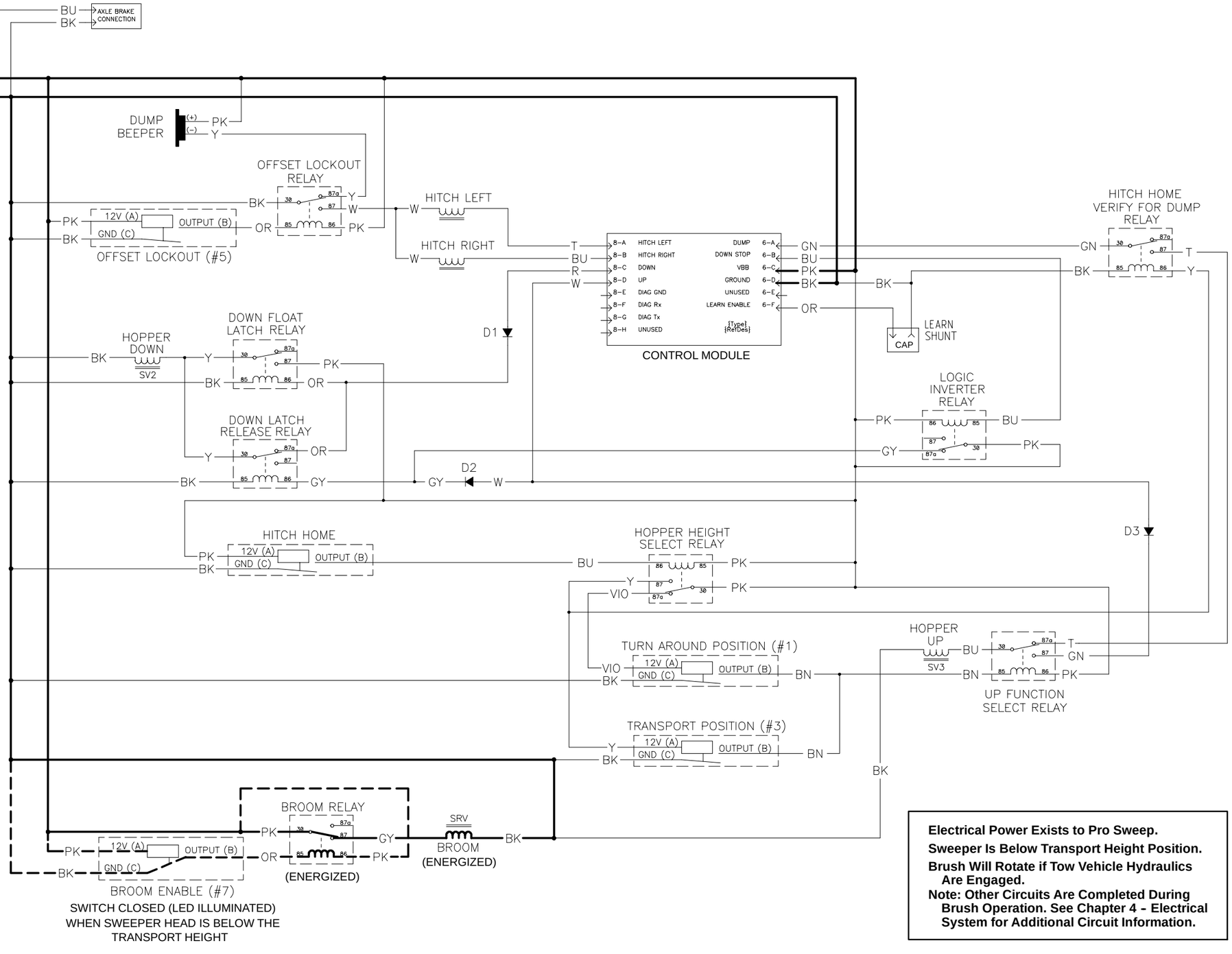
Electrical Schematic

Relays are shown as de-energized

All ground wires are black







Electrical Power Exists to Pro Sweep.

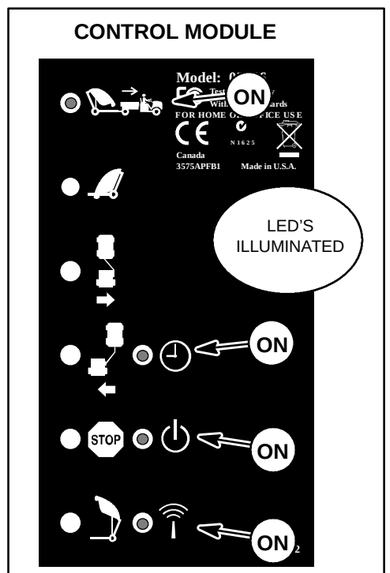
Sweeper Is Below Transport Height Position.

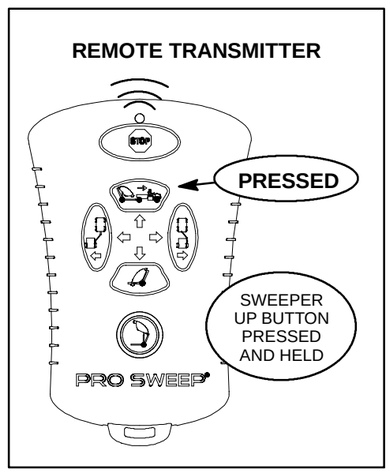
Brush Will Rotate if Tow Vehicle Hydraulics Are Engaged.

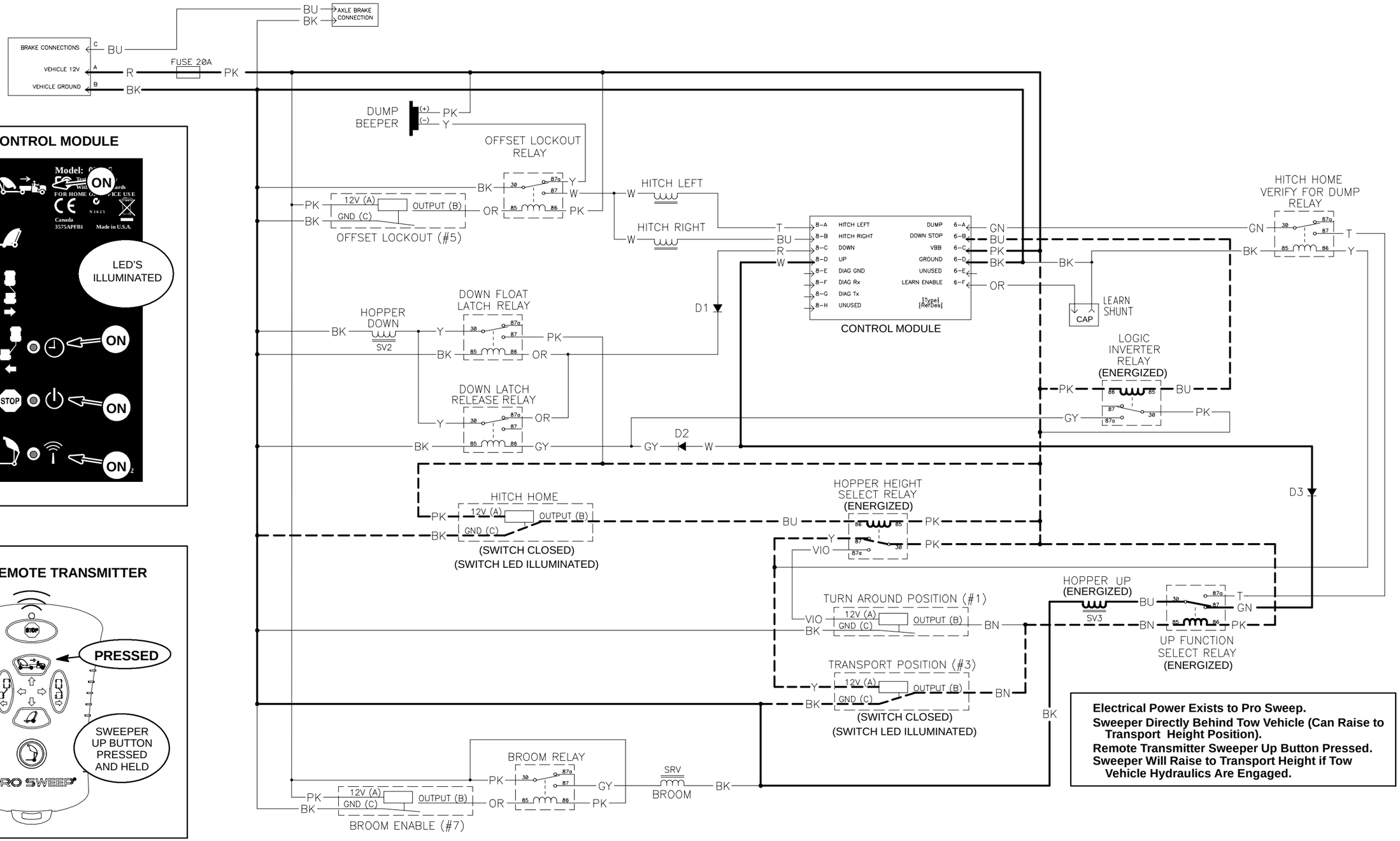
Note: Other Circuits Are Completed During Brush Operation. See Chapter 4 – Electrical System for Additional Circuit Information.

Pro Sweep
Brush Circuit

Power Current
Control Current





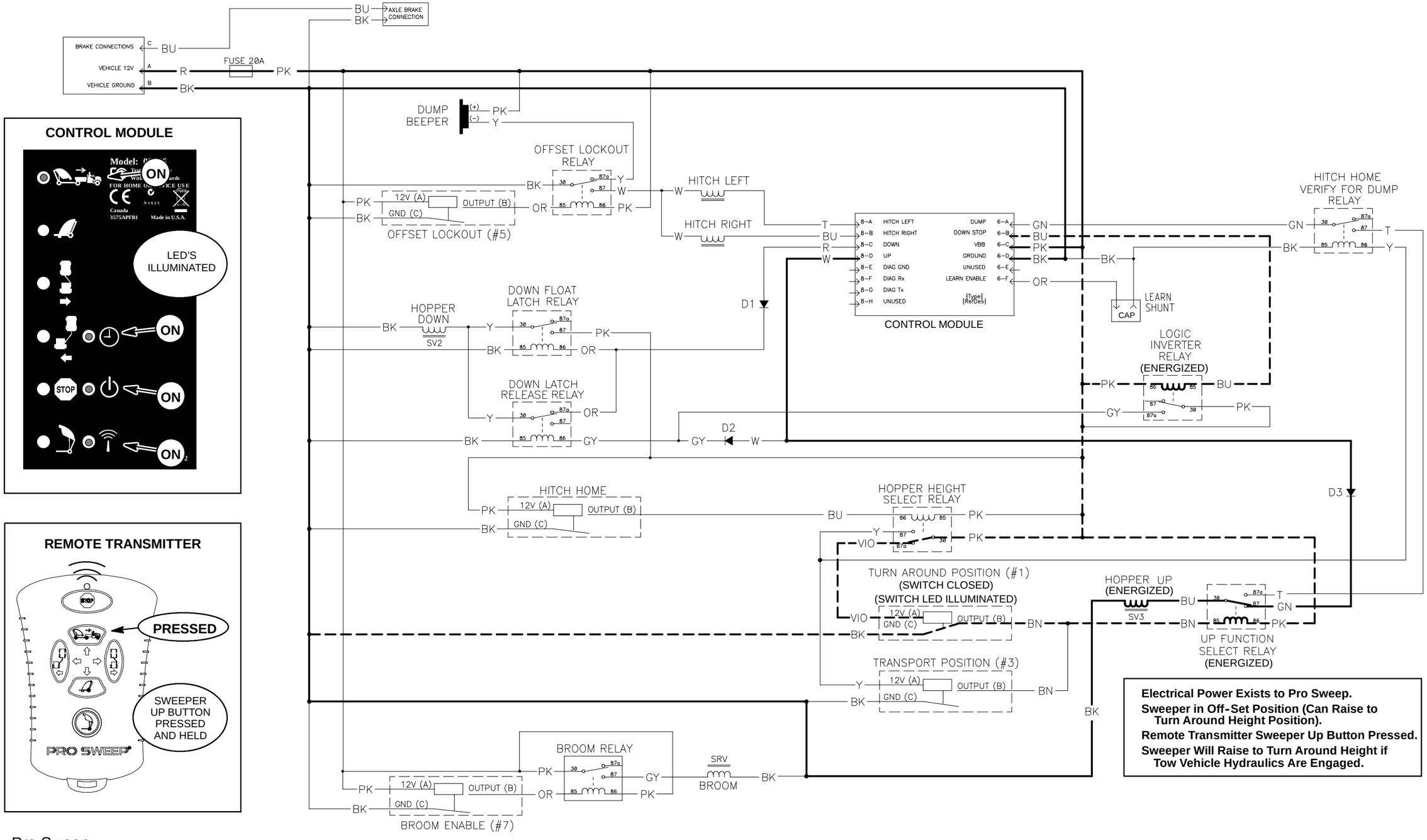


Pro Sweep

Sweeper Raise Circuit (To Transport Height)

Power Current

Control Current

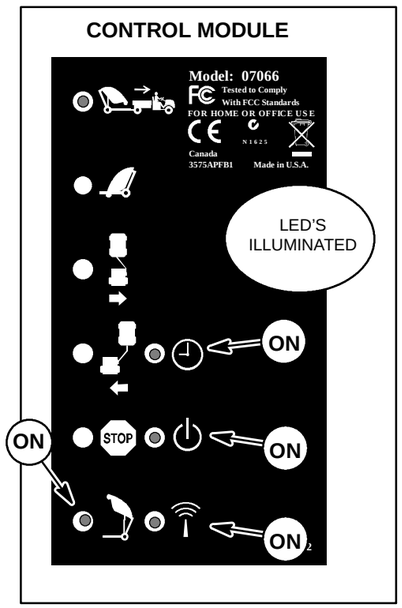


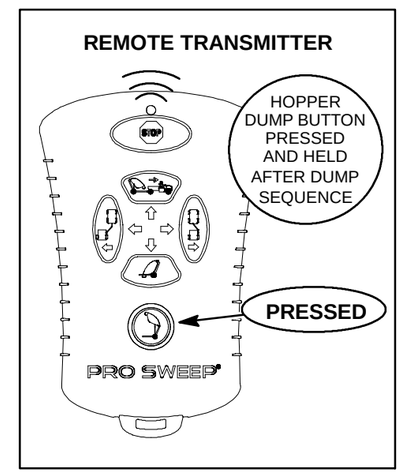
Pro Sweep

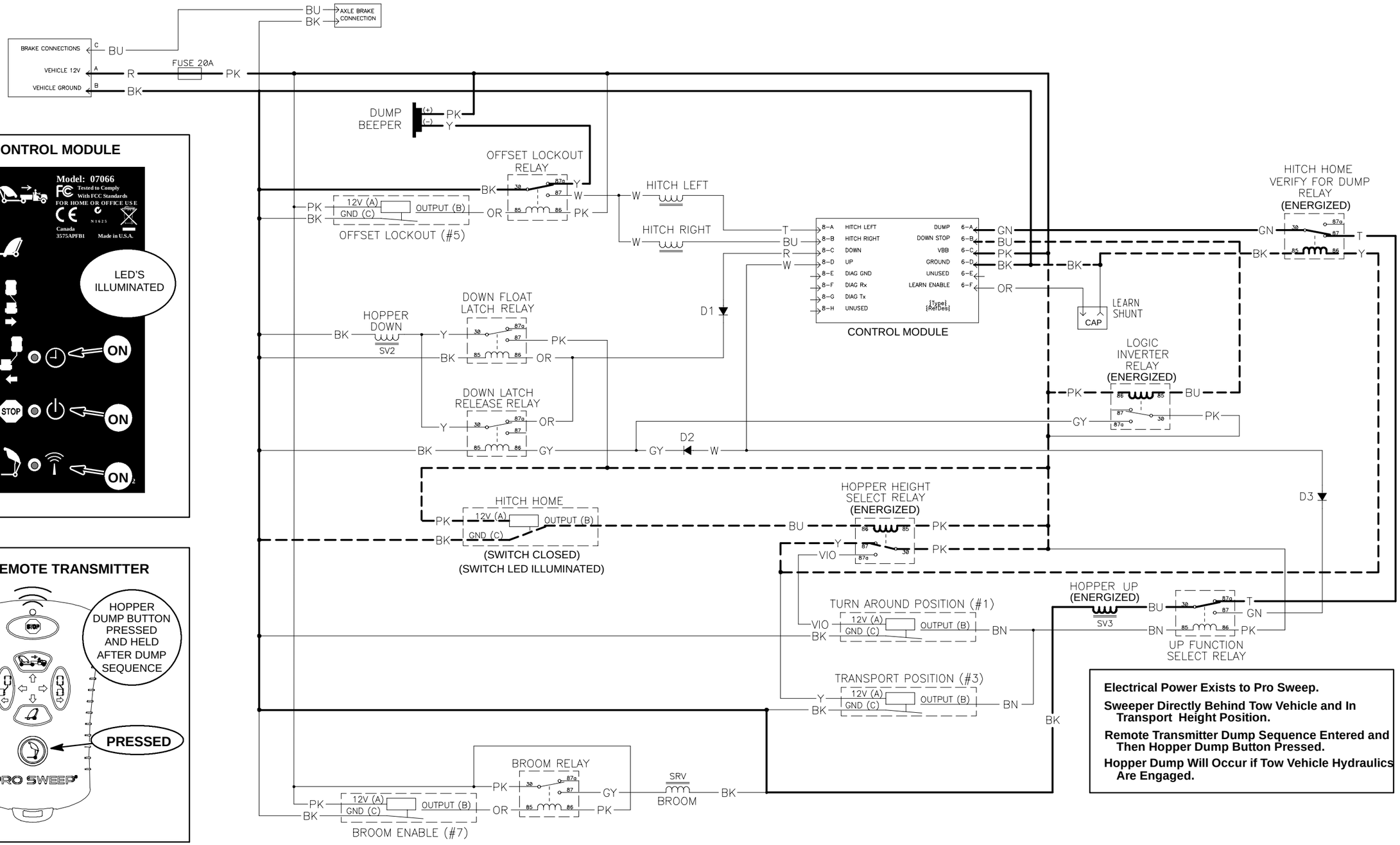
Sweeper Raise Circuit (To Turn Around Height)

Power Current

Control Current

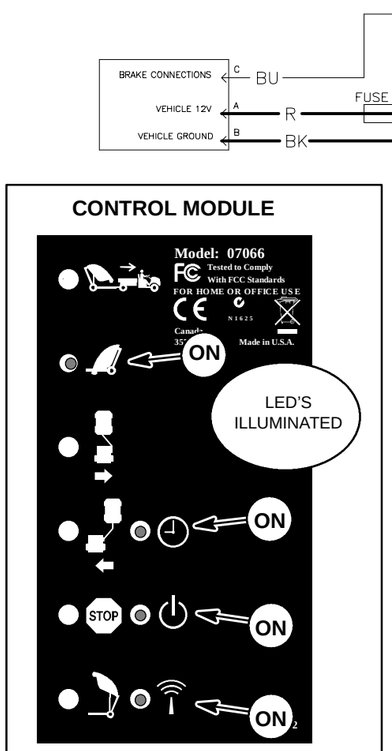


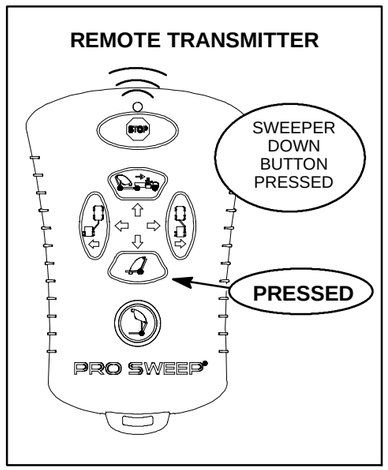


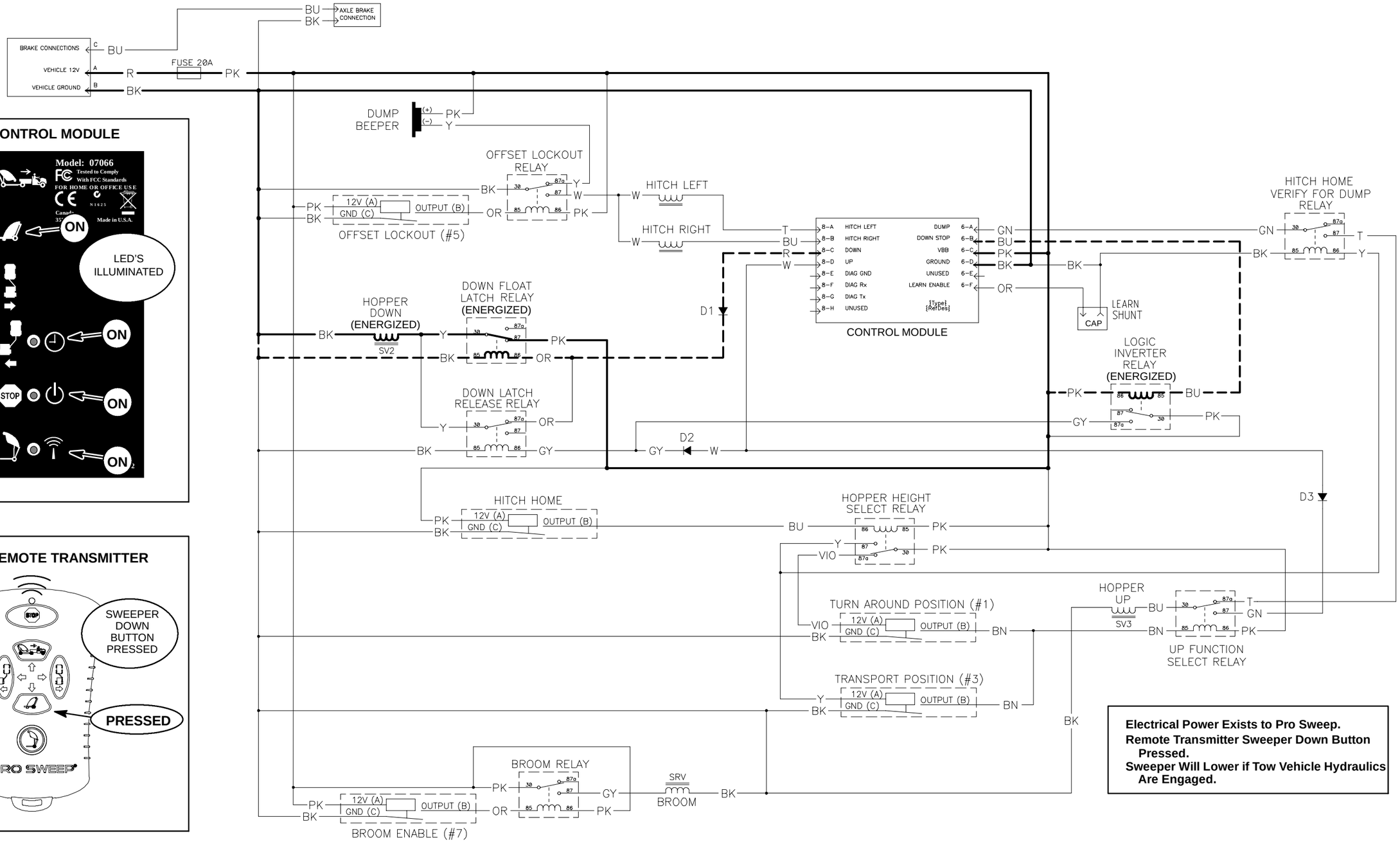


Pro Sweep
Hopper Dump Circuit

Power Current
Control Current







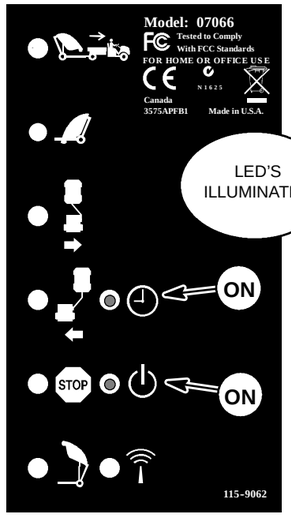
Pro Sweep

Sweeper Lower Circuit (Initiation)

Power Current

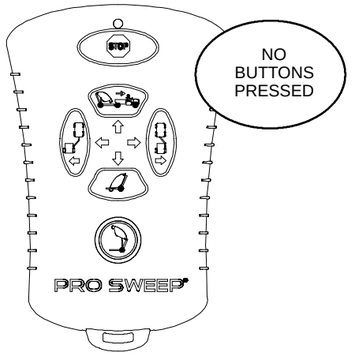
Control Current

CONTROL MODULE



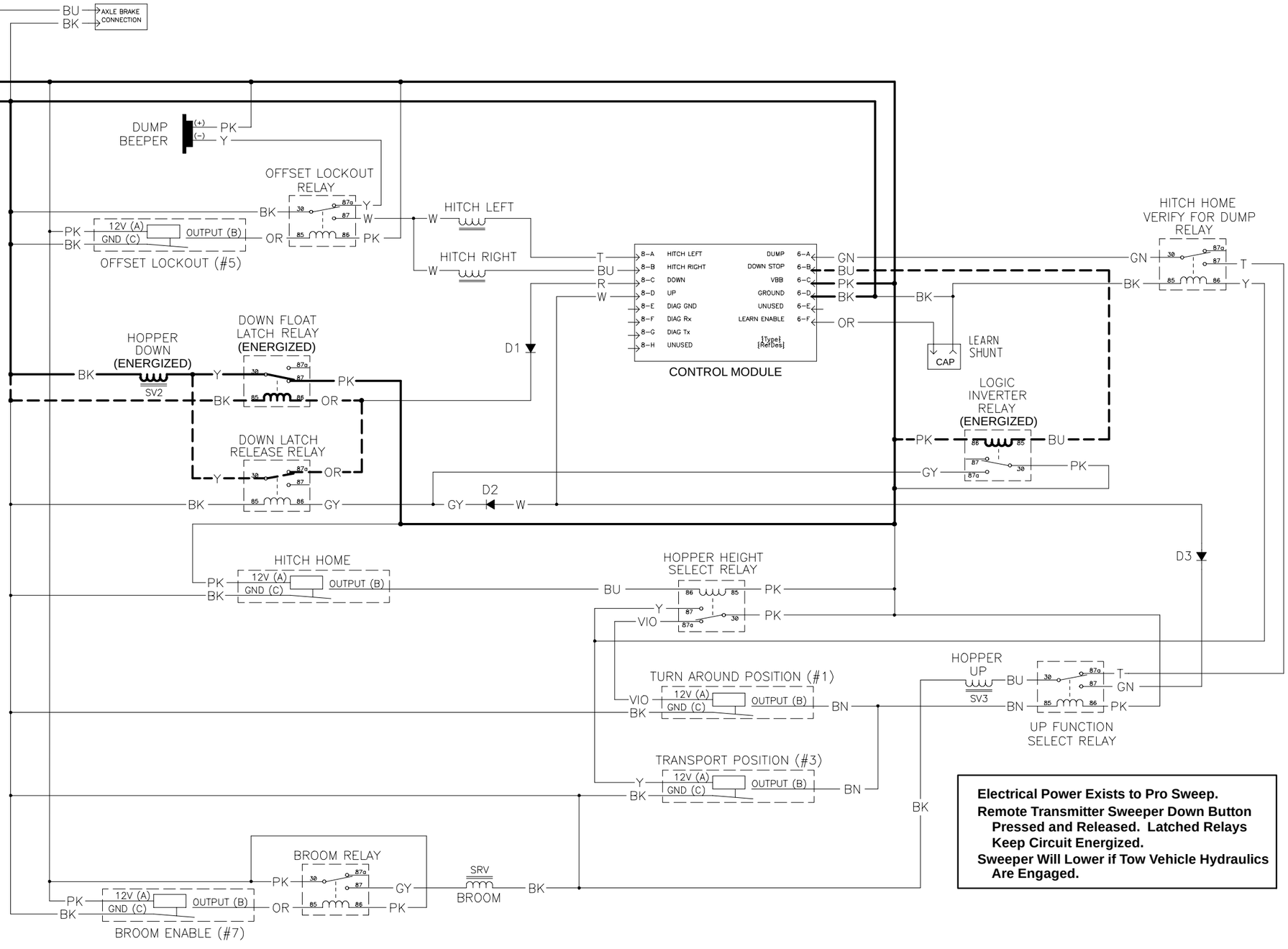
LED'S ILLUMINATED

REMOTE TRANSMITTER



NO BUTTONS PRESSED

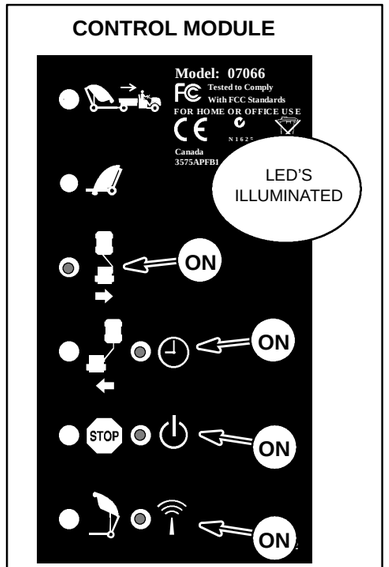
NOTE: TO DE-ENERGIZE THE HOPPER DOWN (SV2) SOLENOID, THE REMOTE TRANSMITTER STOP OR SWEEPER UP BUTTON CAN BE PRESSED. EITHER OF THESE INPUTS WILL ENERGIZE THE DOWN LATCH RELEASE RELAY CAUSING THE DOWN FLOAT LATCH RELAY AND HOPPER DOWN (SV2) SOLENOID TO DE-ENERGIZE.

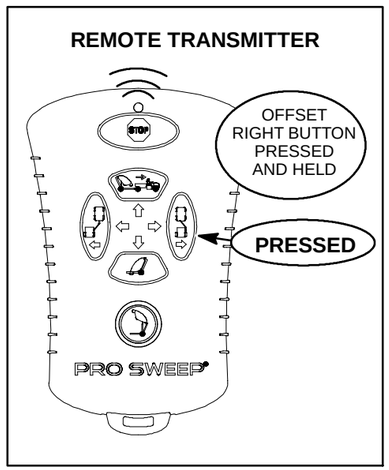


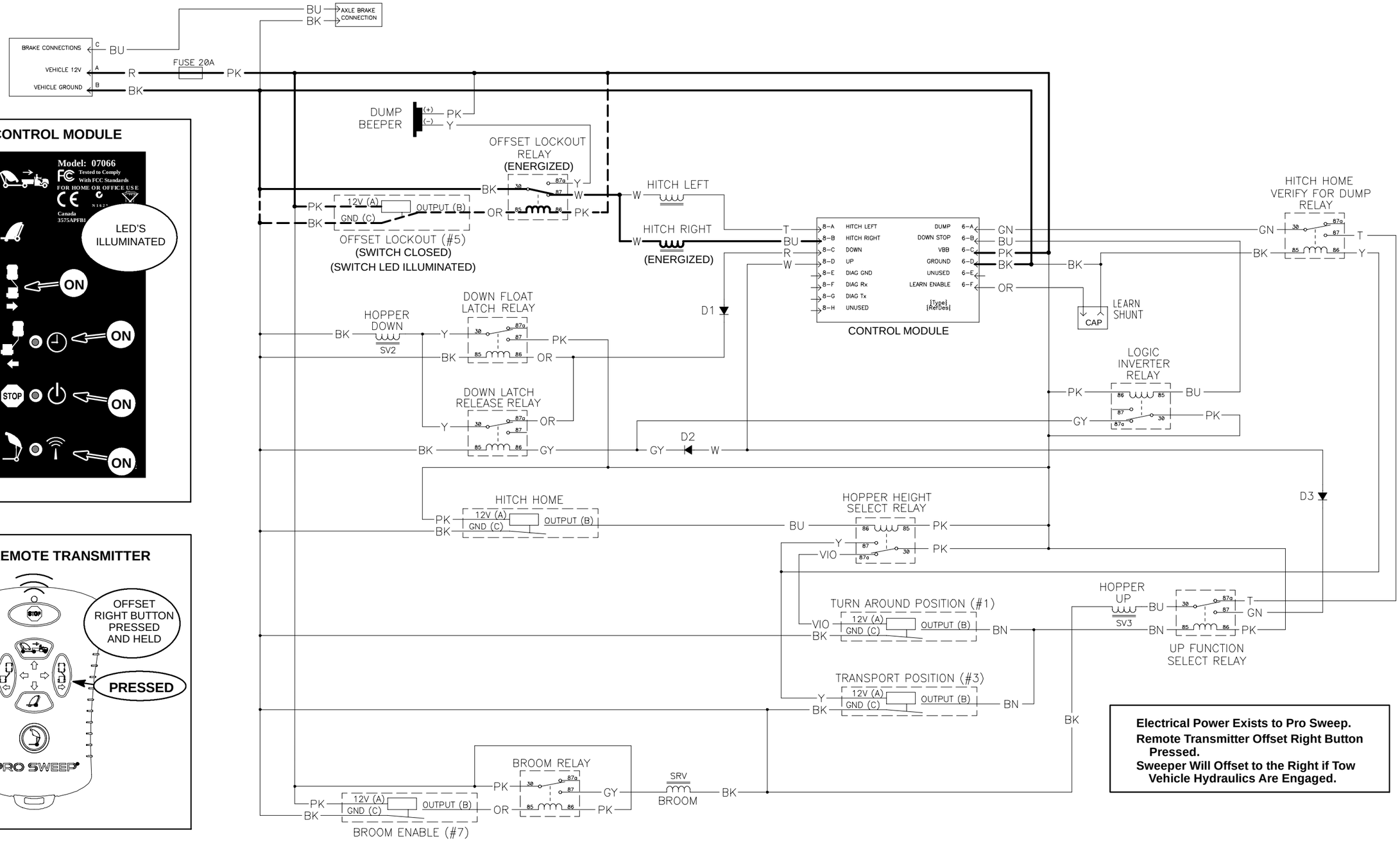
Electrical Power Exists to Pro Sweep.
Remote Transmitter Sweeper Down Button Pressed and Released. Latched Relays Keep Circuit Energized.
Sweeper Will Lower if Tow Vehicle Hydraulics Are Engaged.

Pro Sweep
Sweeper Lower Circuit

Power Current
Control Current





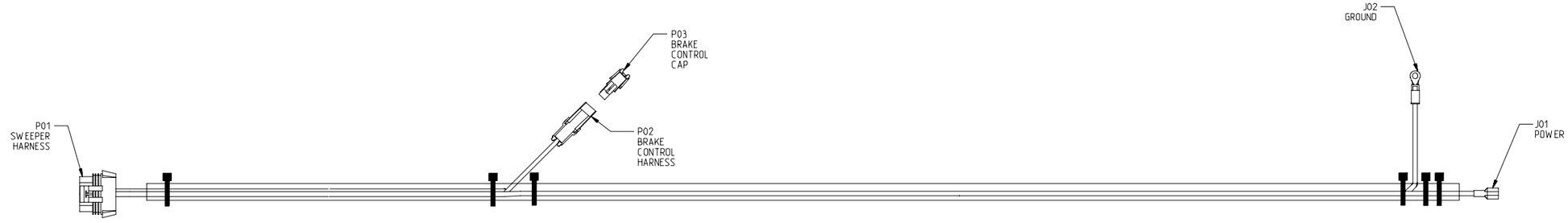


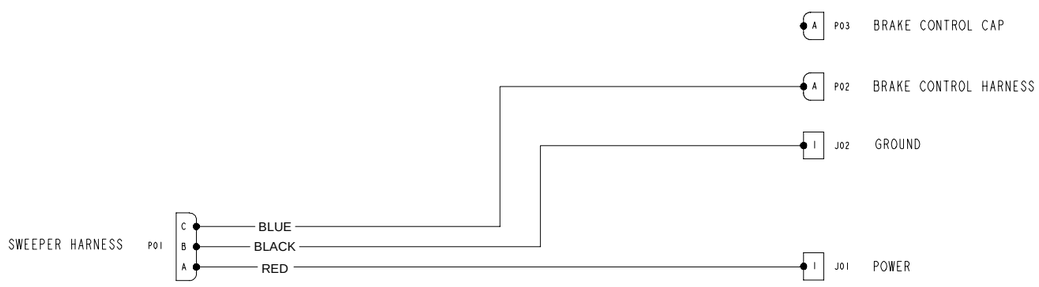
Pro Sweep

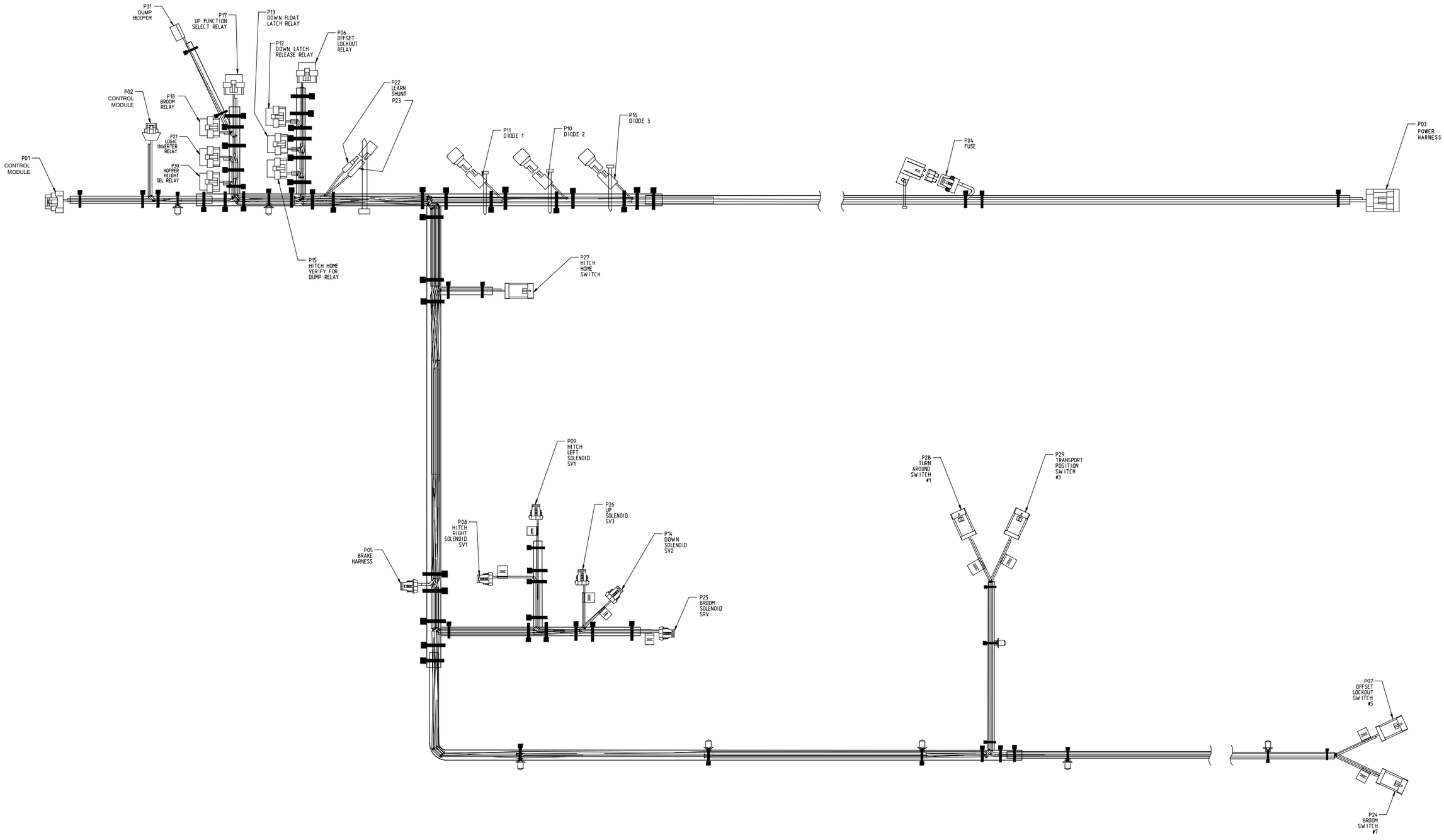
Sweeper Offset Circuit (Offset Right Shown)

Power Current

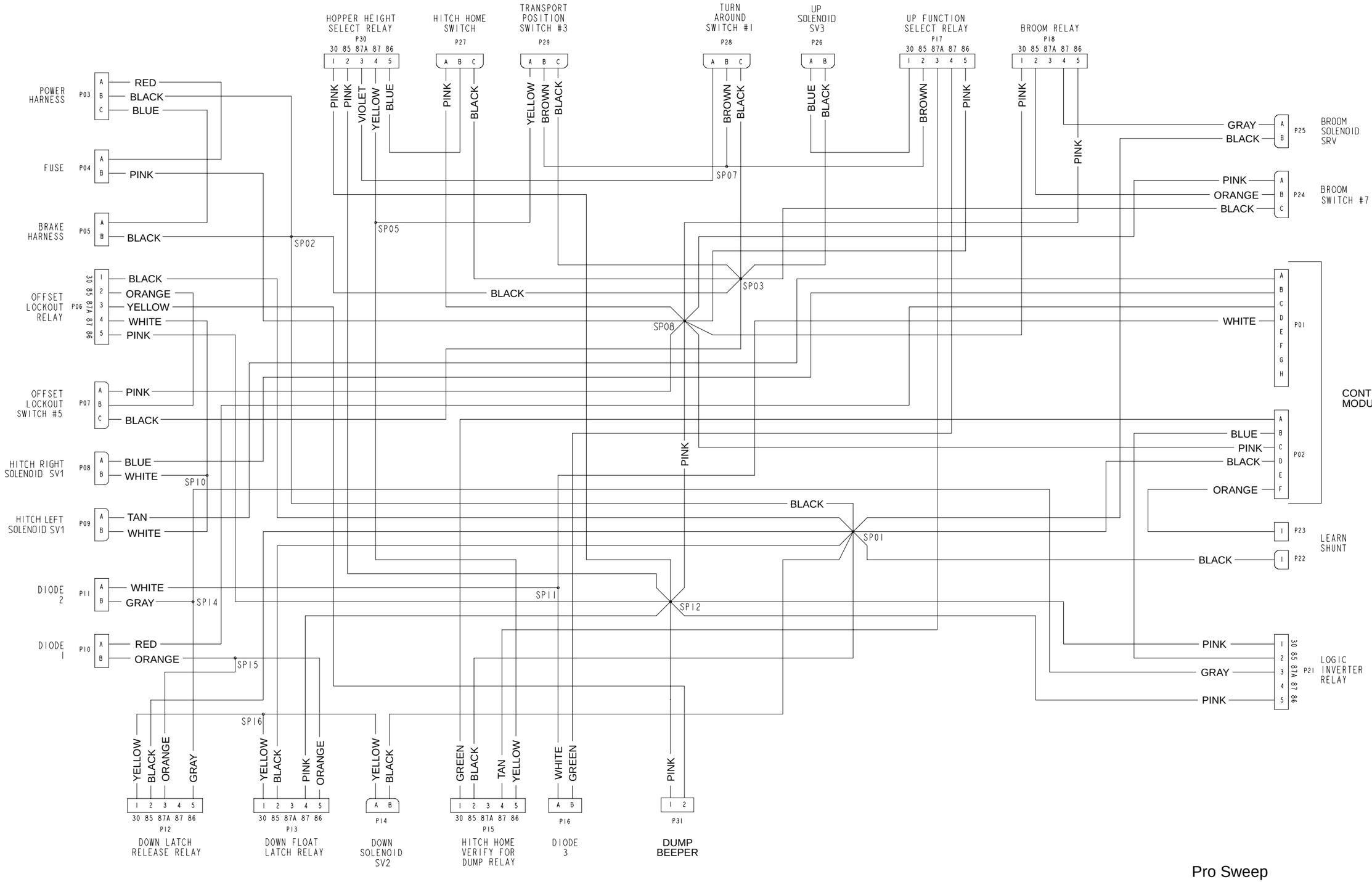
Control Current


P01
SWEEPER
HARNESS
P03
BRAKE
CONTROL
CAP
P02
BRAKE
CONTROL
HARNESS
J02
GROUND
J01
POWER


SWEEPER HARNESS
P01
C
B
A
BLUE
BLACK
RED
A
P03
BRAKE CONTROL CAP
A
P02
BRAKE CONTROL HARNESS
I
J02
GROUND
I
J01
POWER



Pro Sweep
Main Wire Harness Drawing



Pro Sweep

Main Wire Harness Diagram